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EDITORIALS

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Refer to a current issue of the *Journal* for examples of acceptable style and format.

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DOCTOR FOR SOCIETY

REMINISCENCE: ARTEFACTS FROM THE HONG KONG MUSEUM OF MEDICAL SCIENCES

New year, new look, new content

Ignatius TS Yu, FHKAM (Community Medicine)
Editor-in Chief, *Hong Kong Medical Journal*

Hong Kong Med J 2014;20:4
DOI: 10.12809/hkmj131402

As we step into the new year of 2014, the *Hong Kong Medical Journal* (HKMJ) is having a new look. The previous design was used for seven years and the Editorial Board believed that the journal warranted a new dress in this new year.

We spent a lot of time designing the new journal cover that you have received in this issue. It incorporates a modern and clean design; more white space is created, which breaks things up a little, making it easier on the eye. This lets our cover 'breathe', which is exactly what we wanted to achieve—to let our readers enjoy reading the journal in an uncluttered and relaxed way. A skyline of Hong Kong harbour, which is considered one of the best in the world, illustrates our pride for the city. A trimmed version of the Table of Contents is retained on this new cover to provide a quick overview of what is inside in the issue, which is perfect for busy doctors. There is also an 'interior re-design' starting this issue. The font of the text has been changed to a serif one to enhance readability. The abstract page has also been re-organised to better use the space.

Now with the fresher look, the HKMJ is also offering a new section—*Reminiscence: Artefacts from the Hong Kong Museum of Medical Sciences*. This is a collaborative effort with the Hong Kong Museum of Medical Sciences. Each article will consist of photo(s) of artefact(s) held by the Museum together with a short description on the related background or history.

I hope readers will enjoy our new cover and layout, and also the new section.

Physiotherapist-designed aquatic exercise programme for community-dwelling elders with osteoarthritis of the knee: a Hong Kong pilot study

Mary CK Lau *, Joseph KS Lam, Eva Siu, Carmen SW Fung, Kevin TY Li, Margaret WF Lam

ABSTRACT

Objectives: To examine the effectiveness and feasibility of a community-based aquatic exercise programme for elders with osteoarthritis of the knee.

Design: Prospective intervention study, with a before-and-after design.

Setting: Community elders.

Participants: Twenty elders aged 65 years or above (mean, 72 years) attending four Elderly Health Centres of the Department of Health who had suffered from osteoarthritis of the knee for at least 3 years and with mild-to-severe knee pain.

Intervention: A 10-week aquatic exercise programme designed and led by physiotherapists.

Main outcome measures: Range of motion and power of extension of the knees, functional reach test, repeated sit-to-stand test, and the Chinese Arthritis Impact Measurement Scales 2.

Results: There was an improvement in the median range of knee flexion from 115° to 125° (P<0.01) and the median strength of the quadriceps from 9 kg to 21 kg (P<0.001). The median score of the functional reach test increased from 20 cm to 28 cm (P<0.001) and the repeated sit-to-stand test from 10 to 14 repetitions (P<0.001). Also, there was an improvement in the mobility level (P<0.01), walking and bending ability of the trunk (P<0.05), levels of pain (P<0.01) and mood (P<0.01), and the total score (P<0.01) in the Chinese Arthritis Impact Measurement Scales 2.

Conclusions: Physiotherapist-designed aquatic exercise has definite benefits in terms of physical and psychosocial functioning, and should be promoted as one of the strategies to enhance long-term self-management of community elders with knee osteoarthritis.

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New knowledge added by this study

- This physiotherapist-designed aquatic exercise (PDAE) programme significantly improves knee functions, symptoms, and psycho-social functioning of the Hong Kong Chinese knee osteoarthritis (OA) sufferers.
- The PDAE programme was effective and feasible in community settings.

Implications for clinical practice or policy

- This study showed that OA knee sufferers can improve in terms of knee symptoms and functioning by means of the PDAE programme used in a community setting.
- The findings support the application of PDAE programme as a form of long-term self-management for OA knee.

Introduction

Osteoarthritis of the knee (OA knee) is a chronic painful and disabling condition affecting elderly persons worldwide. Among all lower limb joints affected by OA, affliction of the knee is particularly common among the Hong Kong Chinese. A local survey on persons aged 50 years and above revealed that among men, 17% and 7% had persistent knee pain and a confirmed diagnosis of OA knee, respectively; the prevalence rates in women were higher, being 24% and 13%, respectively.[1]

Elderly Health Centres (EHCs) of the Department of Health provide comprehensive primary health care for persons aged 65 years and above. Among attendees of EHCs, OA knee contributes to approximately one third of all physiotherapy referrals.[2]

Physiotherapy in the form of an exercise

prescription (eg hydrotherapy), other treatment modalities (eg heat therapy, transcutaneous electrical nerve stimulation), as well as the prescription of mobility aids for improving ambulation are examples of recommended non-pharmacological therapies for the OA. These are in addition to patient education and self-management programmes.[3] There are many studies documenting the efficacy and effectiveness of aquatic exercises (or hydrotherapy programmes) for reducing pain and improving function in patients with OA or rheumatoid arthritis.[4-8] When one exercises in water, the buoyancy of water decreases loading on lower limb joints. On the other hand, the hydrodynamic resistance and turbulence helps to strengthen muscles and increase proprioception and balance. Hydrostatic pressure also helps to control oedema in the immersed body parts.

This study aimed to examine the effectiveness and feasibility of a community-based aquatic exercise programme for elders with OA knee. The programme, a physiotherapist-designed aquatic exercise (PDAE), was developed by the physiotherapists of the Elderly Health Service (EHS) of the Department of Health.

由物理治療師為膝關節炎社區老人患者設計的水中運動班：香港先導研究

劉昭君、林建成、邵伊華、馮仕為、李統宇、林華鳳

目的：探討為患有膝關節炎的社區老人開展的水中運動班的效用和可行性。

設計：前瞻性介入研究前與後的對比。

安排：社區老人。

參與者：20名65歲或以上（平均72歲）衞生署轄下四個長者健康中心的會員，並患有輕度至嚴重膝關節痛至少三年的長者。

介入：由物理治療師設計及帶領，維期10週的水中運動班。

主要結果測量：膝關節的活動幅度和伸展肌力、功能性伸展測試、反覆坐立測試、和關節炎衝擊測量表2（中文版）（CAIMS 2）。

結果：參加水中運動班後，參與者的膝關節屈曲角度從中位數115°提高至125°（P<0.01），而股四頭肌的力量亦從中位數9 kg增加至21 kg（P<0.001）。功能性伸取測試的中位數從20 cm增加至28 cm（P<0.001），重複坐企測試亦從10次上升至14次（P<0.001）。按CAIMS 2，以下各項均有改善：能動度（P<0.01）、步行和身軀彎曲的能力（P<0.05）、疼痛程度（P<0.01）、情緒（P<0.01）和總分數（P<0.01）。

結論：由物理治療師設計的水中運動，對膝關節炎患者的身體和社會心理功能方面絕對有幫助，建議可把這水中運動班推廣成為加強社區膝關節炎年長患者自我護理的其中一個策略。

Methods

Subjects

Subjects were recruited by convenience sampling of the elders aged 65 years and above attending any one of the four EHCs in Kowloon, Hong Kong.

Inclusion and exclusion criteria

Elders who were recruited had to have a clinical diagnosis of OA knee made by EHC doctors, knee pain for at least 3 years, and a self-perceived pain level of at least 'mild' in the affected knee joint(s) during the preceding 1 month.

Unstable heart disease, hypertension, or any other medical contra-indication to mild-to-moderate physical activity were grounds for exclusion. Other exclusion criteria were physical barriers to exercising in water, such as marked postural deformity, blindness, or deafness; severe cognitive impairment; depression not responding to treatment; neurological diseases like Parkinson's disease and stroke; and inability to walk independently. Subjects who had already received active interventions for OA knee during the preceding 2 months or who had scheduled knee operations in the following 6 months were also excluded.

Interventions

The PDAE consisted of individual and group exercises (Table 1), and was delivered twice a week for 10 weeks in a public indoor swimming pool by registered physiotherapists of the EHS.

All subjects attended a health educational seminar on OA knee and the PDAE before the programme. This addressed the aetiology of OA knee, advice on joint care, skills about coping with daily living and self-help tips on symptomatic relief, a rundown of the programme, and the preparation required before undertaking the aquatic exercises.

Measurements

Characteristics of subjects

Measurements were carried out in the week preceding and then following the intervention. Demographic and co-morbidity data, including the body mass index (BMI), were collected at baseline. The history of knee pain and its management, self-reported levels of involvement in household work and exercise habits, and details about each subject's living environment were also documented.

Outcome measures

The outcome measures were:

(1) Self-reported changes in the use of analgesics (type and frequency of use).
(2) Changes in functional status, intensity and pattern of pain, social activity, and level of tension and mood, as measured by the Chinese Arthritis Impact Measurement Scales 2 (CAIMS 2). The CAIMS 2 has been validated on Chinese-

TABLE 1. Details of the physiotherapist-designed aquatic exercise (PDAE) programme

Content of PDAE	Time (mins)	Equipment
Warm-up on land and in water	10	-
Stepping with arm movement in water	3	-
Rest by slow stepping	~1.5	-
Alternate hip and knee flexion and extension	3	Float on waist
Bilateral hip abduction and adduction	3	Floats on waist and ankles
Bilateral hip and knee flexion and extension	3	Floats on waist and ankles
Rest by slow stepping	~1.5	-
Semi-squatting with arm movement in water	3	-
Group exercise by stepping and gentle jumping in multiple direction	12	-
Cool down in water	10	-

speaking patients with arthritis[9] (Table 2). Thirty relevant items were extracted using CAIMS 2 in the current study, and dealt with mobility, lower limb functions, arthritis pain, and psychosocial status.

(3) Functional exercise capacity was measured by the 6-minute walk test, which measures the maximum distance walked along a 50-metre indoor course in 6 minutes.[10] Learning effects were minimised by testing each subject once in the pre- and post-test, respectively and by a 3-month period between the tests.

(4) Lower limb strength and function were measured using the dynamometer test of the Nicholas Manual Muscle Tester (NMMT) and the 30-second repeated sit-to-stand test. The NMMT measures isometric quadriceps muscle strength at 30° of knee flexion. The 30-second repeated sit-to-stand test entails counting the number of completed repetitions by the subject in 30 seconds, and reflects composite functional strength contributed by extension of the back and legs.

(5) Standing balance was measured by the functional reach test (FRT), which measures the maximum displacement in horizontal distance that the subjects can reach when they stand still. Scores of less than 6 inches (15.2 cm) indicate limited functional balance, 6 to 10 inches indicate a moderate fall risk, and that of more than 10 inches (25.4 cm) indicate less fall risk.[11]

(6) The range of motion (ROM) of the knee joints was measured by a goniometer with the subject in a lying position. The range is one of the mediators for the improvement in overall knee function.

Programme feasibility

The feasibility of running the PDAE programme in the community was assessed as follows:

(a) Difficulties encountered and subjects' concerns during the recruitment;
(b) Attendance during programme implementation and reasons of absence;
(c) Observation of subjects' performance during the PDAE programme; and
(d) Post-study programme evaluation including subjects' satisfaction and their opinion on future service planning.

Statistical methods

Analyses were performed using the Statistical Package for the Social Sciences (Windows version 10.0; SPSS Inc, Chicago [IL], US). Differences in range of knee movement, quadriceps strength, FRT, repeated sit-to-stand test, 6-minute walk test, and CAIMS 2 scores before and after the PDAE were tested by the Wilcoxon signed rank test, while the difference in the use of analgesic medications for knee pain was tested by McNemar's test.

To detect a change of 20% in the pain and physical functioning scales of CAIMS 2 with an α level of 0.05 and 80% power, a sample size of 18 was necessary according to the computer equation for the Wilcoxon signed rank test. To allow for a dropout rate of 20%, 22 subjects were recruited.

Results

Subject characteristics

There were 22 subjects, of whom 20 (15 female and 5 male) completed the PDAE programme. Two withdrew from the study—one due to personal and adjustment problems to water temperature, while the other did not attend the post-programme assessment. The mean (± standard deviation) age of the subjects was 72 ± 2 years. In all, 35% of them were illiterate and 50% had had a primary school education (Table 3). Apart from OA of the knee, 65% of them had other musculoskeletal problems. Moreover, 65% of the subjects lived in public housing and the rest in private housing. All of them were

TABLE 2. The selected items for physiotherapist-designed aquatic exercise assessment out of the original Chinese Arthritis Impact Measurement Scales 2 (CAIMS 2) questionnaire[9]

No.	Question in CAIMS 2	Selected items in the study
	Questions refer to mobility level	
1	How often were you physically able to drive a car or use transportation?	✓
2	How often were you out of the house for at least part of the day?	✓
3	How often were you able to do errands in the neighbourhood?	✓
4	How often did someone have to assist you to get around outside your home?	✓
5	How often were you in a bed or in a chair for most of the day?	✓
	Questions refer to walking and bending. During the past month...	
6	Did you have trouble doing vigorous activities such as running, lifting heavy objects, or participating in strenuous sports?	✓
7	Did you have trouble either walking several blocks or climbing several flights of stairs?	✓
8	Did you have trouble bending, lifting, or stooping?	✓
9	Did you have trouble either walking one block or climbing a flight of stairs?	✓
10	Were you unable to walk unless assisted by another person or by a cane, crutches, or walker?	✓
11-16	Questions refer to hand and finger function	×
17-21	Questions refer to arm function	×
22-26	Questions refer to self-care tasks	×
27-30	Questions refer to household tasks	×
	Questions refer to social activity	
31	How often did you get together with friends or relatives?	✓
32	How often did you have friends or relatives over to your home?	✓
33	How often did you visit friends or relatives at their homes?	✓
34	How often were you on telephone with close friends?	✓
35	How often did you go to a meeting of a church, club, team, or other group?	✓
36-39	Questions refer to support from family and friends	×
	Questions refer to arthritis pain. During the past month...	
40	How would you describe the arthritis pain you usually had?	✓
41	How often did you have severe pain from your arthritis?	✓
42	How often did you have pain in two or more joints at the same time?	✓
43	How often did your morning stiffness last more than 1 hour from the time you woke up?	✓
44	How often did your pain make it difficult for your sleep?	✓
45-49	Questions refer to work	×
	Questions refer to level of tension. During the past month...	
50	How often have you felt tense or high strung?	✓
51	How often have you been bothered by nervousness or your nerves?	✓
52	How often were you able to relax without difficulty?	✓
53	How often have you felt relaxed and free of tension?	✓
54	How often have you felt calm or peaceful?	✓
	Questions refer to mood. During the past month...	
55	How often have you enjoyed the things you do?	✓
56	How often have you been in low or very low spirits?	✓
57	How often did you feel that nothing turned out the way you wanted it to?	✓
58	How often did you feel that your arthritis is a burden of others?	✓
59	How often did you feel so down in the dumps that nothing would cheer you up?	✓

involved in managing household chores at moderate (60%) and light (40%) intensity levels, and 90% of them had direct lift access to their homes.

Before participating in PDAE programme, 16 of the subjects had pain in both knees and four in one knee only. Specific causes of the knee pain were not identified in 15 of them. Two subjects had pain in one knee without specific cause but the other knee by trauma. Two subjects had knee pain due to overuse. Another subject had knee pain due to overuse and trauma. The main aggravating factors were climbing stairs, squatting, weather changes, and getting up from a sitting to standing position (Table 3).

Nearly all the subjects (90%) undertook exercises of different forms and intensity; 94% claimed to exercise daily, 78% claimed to exercise 30 to 60 minutes per day, and some (17%) claimed to exercise for more than 1 hour a day. Reported land-based exercises included walking (60%), general mobilisation exercise (55%), and Tai Chi (40%). Half of the subjects encountered difficulties performing daily activities (brisk walking, single-leg standing, squatting, getting up or standing from squatting, or sitting on a low stool) due to knee problems. Subject demographics and clinical features are described in Table 3.

Body mass index

There was no significant difference in the subjects' mean BMI before and after the PDAE programme (26.6 vs 26.6 kg/m^2; P=0.658).

Pain-relieving medications

Before PDAE, more than half of the subjects used analgesic ointments/patches for self-management of knee pain. Apart from medication, only one subject exercised specifically to relieve pain and stiffness in his knee. Three quarters of the subjects found their self-management slightly effective and 20% found it moderately effective.

After PDAE, the number of subjects taking pain-relieving medications decreased (19 vs 4; P=0.004), and the numbers relying on oral analgesics decreased from four to one (Table 4).

Outcomes

According to observations by physiotherapists, subjects with knee swelling all experienced a decrease (10 vs 0 knees; P=0.002). There was also a decrease in the girth of the thigh (measured at 5 cm above the base of patella in both knees) from a mean of 40 cm to 39 cm (P<0.001), despite a substantial increase of muscle strength (Tables 5 and 6).

Owing to the small sample size and skewed data distribution, medians and the non-parametric Wilcoxon signed rank test were used to compare functional outcomes and CAIMS 2 scores.

The medians of the knee ROM increased from 115° to 125° (P<0.01) after the PDAE, while those for total ROM increased from 120° to 125° (P<0.05). The number of subjects who got end-of-range pain at flexion decreased from 16 to 8 (P<0.05). There was also a marked improvement

TABLE 3. Demographic and clinical characteristics of the sample*

Characteristic	% of patients	
Gender		
Female	75	
Male	25	
Education level		
Illiterate	35	
Primary school	50	
Form 3	5	
Form 5	5	
Matriculated	5	
Side of knee suffering from pain		
Both sides	80	
Left	10	
Right	10	
Area of knee pain	Left	Right
Anterior	60	65
Posterior	5	10
Medial	10	5
Lateral	0	0
Diffused	20	20
Cause of knee pain		
Unknown	85	
Overuse	15	
Trauma	15	
Aggravating factors		
Up/down stairs	65	
Squatting	60	
Weather change	55	
Getting up from sitting to standing	50	
Up/down slopes	35	
Standing	35	
Walking (level ground)	25	
Housework	20	
Others	25	
Usual type of exercise performed		
Walking	60	
General mobilisation	55	
Tai Chi	40	
Others	15	

* Some of the patients had more than one area of knee pain, cause of knee pain, aggravating factor, and usual type of exercise performed

in the medians for quadriceps strength from 9 kg to 21 kg (P<0.001), FRT from 20 cm to 28 cm (P<0.001), and the repeated sit-to-stand test from 10 to 14 repetitions (P<0.001). There was a slight improvement in the median for the 6-minute walk test (Table 5).

There was a significant improvement in mobility level, walking and bending ability of trunk, levels of pain and mood, as well as the total score as measured by CAIMS 2 (Table 6).

TABLE 4. Frequency and type of analgesic medication used before and after physiotherapist-designed aquatic exercise (PDAE) programme

Analgesic medication	No. of patients	
	Before PDAE	After PDAE
Type		
Ointments	8	2
Patches	7	1
Pills	4	1
Injections	0	0
Frequency (per week)		
1-2	14	4
3-5	3	0
≥6	2	0

Discussion

Effectiveness of physiotherapist-designed aquatic exercise programme

Osteoarthritis is associated with muscle atrophy, reduced muscle strength, and decreased ROM. Studies have shown that strength and ROM of women with arthritis are often 70 to 85% that of women of similar age without arthritis.[12] Quadriceps weakness is common among patients with OA knee, which is believed to be due to disuse atrophy, as patients tend to unload the painful extremity.[3] Osteoarthritis is a common disorder in persons older than 65 years and can significantly affect quality of life.[13]

The goal of the PDAE programme was to improve knee function for the OA-affected knee. In this study, the intervention was associated with a reduction in knee pain, improved strength of

TABLE 5. Functional parameters of the knee before and after physiotherapist-designed aquatic exercise (PDAE) programme

Function	Median (interquartile range)		P value
	Before PDAE	After PDAE	
ROM in flexion (degrees)	115 (110-122)	125 (115-125)	0.009
Flexion with EOR pain (No. of subjects)	16	8	0.039
ROM in extension (degrees)	0 (0-0)	0 (-1.25 to 0)	0.969
Extension with EOR pain (No. of subjects)	8	5	0.453
Total ROM (degrees)	120 (110-120)	125 (115-126)	0.012
Strength of quadriceps (kg)	9 (5-12)	21 (12-25)	<0.001
Functional reach test (cm)	20 (16-22)	28 (24-30)	<0.001
Repeated sit-to-stand test (No. of repeats)	10 (8-12)	14 (13-18)	<0.001
6-Minute walk test (m)	365 (306-425)	371 (326-404)	0.092
Walk with knee pain (No. of subjects)	7	5	0.625
Walk with limping gait (No. of subjects)	5	2	0.25

Abbreviations: ROM = range of motion; EOR = end of range

TABLE 6. The Chinese Arthritis Impact Measurement Scales 2 (CAIMS 2) scoring before and after physiotherapist-designed aquatic exercise (PDAE) programme

Different aspect of CAIMS 2	Median (interquartile range) score		P value
	Before PDAE	After PDAE	
Mobility level	0.5 (0.1-2.4)	0.0 (0.0-0.5)	0.002
Walking and bending ability of trunk	2.0 (0.0-3.9)	0.0 (0.0-1.5)	0.032
Social activities	5.3 (4.0-6.5)	5.5 (4.5-7.5)	0.243
Level of pain	2.8 (2.0-4.0)	1.5 (0.5-2.0)	0.001
Level of tension	1.5 (0.5-2.5)	1.0 (0.0-2.5)	0.054
Mood	1.0 (0.1-2.5)	0.0 (0.0-0.5)	0.003
Total	**14.0 (9.0-19.9)**	**9.0 (7.0-13.0)**	**0.001**

knee extensors, improved knee ROM, and overall body balance; all of which were confirmed by improvements in the sit-to-stand test.

The advantage of exercising in an aquatic environment is that in comparison to usual weight-bearing exercises, water buoyancy decreases stress on the lower limb joints and surrounding muscles, which provides the ideal medium for pain and stiffness relief from arthritis. Turbulence and its dynamic resistance is another property that can strengthen all muscle groups surrounding the knee, and improve proprioception and body balance.[5]

The results of this study were concordant with the mentioned benefits of the multi-direction resistance provided by the water environment, such that PDAE strengthens the quadriceps effectively. The increased muscle strength around affected joints is a clinically important outcome, as muscles provide shock-absorbing capacity and joint stability to help preserve the diseased joint.[4] The decrease in knee joint girth might be explained by reduced swelling and the proximal lift from muscle bulk of the quadriceps and hamstrings due to improved muscle tone.

Moreover, the turbulence of water not only provides resistance but also a multi-directional balance challenge. The aquatic environment enables subjects with intrinsic fall risk factors to exercise safely in functional positions. In this study, improvements in trunk movement ability were also noted in the CAIMS 2 questionnaire. The above factors may be the main reasons for improvement in functional balance. In this study, the medians of the subjects' FRT test results after PDAE improved from a moderate level of fall risk to a less risky level. This change concurs with Simmons and Hansen's findings,[13] whereby greater improvement in functional reach occurred in subjects who had exercised in an aquatic environment. Challenges to balance in an aquatic environment appear to improve dynamic standing balance on land. This is further supported by motor learning literature, where learners demonstrated the ability to apply what they had learnt from different practice conditions and/or movement skills.[14] Standing balance training, if sufficiently dynamic in nature, may also improve the performance of functional activities that combine elements of dynamic balance and overall mobility.[14] Overall, the functional movement of the knee reflected by the sit-to-stand test also improved.

The improvements in the mentioned domains of knee function were contributed to by decreased knee pain after the programme. In reference to the self-management of the knee symptoms, subjects mainly used analgesic ointment and patches. Before the PDAE programme, they might not have realised that exercise was an effective means of improving their knee pain and function. The PDAE programme benefits subjects via performance of suitable exercise so that they are less dependent on drugs and hence drug-induced adverse effects can be reduced.

Moreover, the present study showed that PDAE had added benefits on both the physical and psychological aspects of patients with OA knee. Group interaction and socialisation resulting from the interventions may also have influenced psychological domains positively.[13] Our results were consistent with findings of other investigators, who noted improvements in clinically active joint function after hydrotherapy but not after a land-based exercise programme.[5] Although there was a deterioration in the medians of the sub-score of social activities in CAIMS 2 (P=0.243), this might have been because the latter questionnaire focused on the frequency of getting in touch with friends or relatives, rather than about social activities resulting from the intervention.

Although nearly all subjects undertook exercise and on a daily basis before the programme, there was ample scope for improvement in the physical domains for their knees. This might suggest that different types of exercise, including aquatic exercise, should be performed as part of any exercise programme. Besides, measures should be introduced to reduce risk factors for OA knee, such as weight control by means of diet, exercise, and education.

Feasibility of physiotherapist-designed aquatic exercise programme

The observed positive effects and the high (96%) overall attendance rate showed that the PDAE programme was highly acceptable even for a community-dwelling elderly population. This compares very favourably to an attendance rate of 40 to 55% usually achieved in exercise programmes for persons with arthritis.[15] Satisfactory compliance could be because those who joined the programme could be non-swimmers, and the programme was relatively short in duration (10 weeks). Moreover, it was conducted during relatively warm months in a training pool provided with temperature control by radiators (room temperature ranged between 19°C and 29°C), resulting in an environment warm enough for elders to exercise. Finally, there was good rapport between the subjects and the physiotherapists. Timely advice, support, and encouragement by the physiotherapists might also encourage the subjects to adhere to the programme schedule. Although these components were not evaluated in the programme, one might speculate that emphasis on these aspects helped attain the high degree of compliance.

During the recruitment period and implementation of the PDAE, no difficulties or adverse effects were encountered. The subjects

found the exercise intensity of the PDAE suitable (mean rate of perceived exertion = 3.3 ± 1.3). Also, all the participants were satisfied with the programme and accepted its benefits, particularly as the PDAE was feasible for implementation in public swimming pool within a community setting.

Limitation

A major limitation of this study was the lack of a control group. Therefore, there was no yardstick for comparing the effects of the PDAE with no intervention. Secondly, comparison of outcome measures before and after PDAE could have been influenced by co-interventions (eg use of massage, improvements in posture during daily activities, performance of other types of muscle-strengthening exercises). Moreover, the subjects recruited from EHCs might well be more motivated and health conscious than others. Thirdly, the outcomes were measured without blinding, such that there was always some measurement bias. Finally, the relatively small sample size and recourse to convenience sampling may have conferred imprecision and bias.

The benefits of aquatic exercise were already well established in other studies. Our study confirmed its effectiveness for OA knee, specifically in a public swimming pool within a community setting. Furthermore, the experience we gained was valuable for the conduct of any future aquatic exercise programme in the community.

Conclusions

The PDAE showed appreciable benefits in terms of reducing knee pain, and improving knee function, body balance, and the psychosocial health of elders with OA knee, including non-swimmers. Populations with OA knee problems and with or without those related to weight-bearing exercise benefited from aquatic exercise. The results justify continuing investment in aquatic exercise programmes as one of the strategies to enhance long-term self-management for elders with chronic OA knee.

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Intensive care unit admission of obstetric cases: a single centre experience with contemporary update

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A B S T R A C T

Objectives: To review the characteristics of a series of obstetric patients admitted to the intensive care unit in a regional hospital in 2006-2010, to compare them with those of a similar series reported from the same hospital in 1989-1995 and a series reported from another regional hospital in 1998-2007.

Design: Retrospective case series.

Setting: A regional hospital in Hong Kong.

Patients: Obstetric patients admitted to the Intensive Care Unit of Kwong Wah Hospital from 1 January 2006 to 31 December 2010.

Results: From 2006 to 2010, there were 67 such patients admitted to the intensive care unit (0.23% of total maternities and 2.34% of total intensive care unit admission), which was a higher incidence than reported in two other local studies. As in the latter studies, the majority were admitted postpartum (n=65, 97%), with postpartum haemorrhage (n=39, 58%) being the commonest cause followed by pre-eclampsia/eclampsia (n=17, 25%). In the current study, significantly more patients had had elective caesarean sections for placenta praevia but fewer had had a hysterectomy. The duration of intensive care unit stay was shorter (mean, 1.8 days) with fewer invasive procedures performed than in the two previous studies, but maternal and neonatal mortality was similar (3% and 6%, respectively).

Conclusion: Postpartum haemorrhage and pregnancy-induced hypertension were still the most common reasons for intensive care unit admission. There was an increasing trend of intensive care unit admissions following elective caesarean section for placenta praevia and for early aggressive intervention of pre-eclampsia. Maternal mortality remained low but had not decreased. The intensive care unit admission rate by itself might not be a helpful indicator of obstetric performance.

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New knowledge added by this study

- There was an increasing trend of obstetric intensive care unit (ICU) admissions but with shorter stays.
- Well-planned fertility-sparing treatments for postpartum haemorrhage and placenta praevia may decrease resorting to hysterectomy.

Implications for clinical practice or policy

- Other performance indicators in addition to crude ICU admission rates should be established to evaluate obstetric standards.

Introduction

Obstetric admissions to the intensive care unit (ICU) and maternal mortality continue to have a significant impact on maternal health care, despite the low rate of such admissions in developed countries.[1] Unlike others, obstetric patients pose a major management challenge to ICU physicians and obstetricians due to altered physiology during pregnancy, consideration of fetal wellbeing, and the unique type of disorders to be dealt with.

Despite ongoing improvements in obstetric care, more patients were admitted to ICU in the reviewed period compared with decades earlier.[2] Thus, the purpose of this study was to review and compare the characteristics of obstetric patients admitted to the ICU over the recent 20 years using historical controls, with respect to their epidemiology, medical background, antenatal and peripartum risks, durations of ICU stay, interventions in the ICU, and predictability of the Acute Physiology and Chronic Health Evaluation (APACHE II) score, as well as maternal and fetal outcomes.

Methods

This was a retrospective case series of obstetric patients admitted to the ICU of Kwong Wah

Hospital, Hong Kong, over a 5-year period from 1 January 2006 to 31 December 2010. Our hospital provides joint care with seven other hospitals in the Kowloon West Cluster to residents of six districts, which account for about 1.9 million inhabitants. Our obstetric service is available for 24 hours each day for women in parts of the Kowloon West and Wong Tai Sin districts. We provide out-patient and in-patient services, including antenatal check-ups, prenatal diagnoses, elective and emergency operations and services that are supported by a blood bank and various laboratory test facilities available for patients in hospital and in the community. Moreover, 24-hour midwifery, and perinatal and anaesthetic services are available in our delivery suite. Our team consists of consultants, associate consultants, as well as senior and junior residents. Three staff (one specialist, two residents) are always available on site for emergency admissions. Annually, we manage 5000 to 6000 deliveries, which is one of the highest delivery rates for a Hong Kong hospital. Our ICU was established in 1968, currently has 14 beds, and admits 500 to 600 patients every year. The ICU team consists of a critical care physician, a resident anaesthetist, medical and surgical residents, and a nursing team with critical care–registered nurse specialists.

This study was approved by the Ethics Committee of the Kowloon West Cluster, Hospital Authority. No patient consent was required as the study only involved review of medical records.

Obstetric patients from 24 weeks of gestation onwards to 6 weeks postpartum admitted to the ICU were reviewed. They were identified via the computerised database system adopted by the ICU. All corresponding medical records were reviewed in detail. Supplementary information was retrieved from the Clinical Management System, Electronic Patient Record, and Obstetrics Clinical Information System.

Data retrieved for analysis included patient demographics (age, ethnicity, smoking and drinking status, parity, order of pregnancy, and body mass index [BMI] at booking visit), antenatal booking status, number of antenatal visits, medical history, perinatal risks, gestation at and mode of delivery, indications for caesarean section, interventions involved at and after delivery, indications and admission status to the ICU, and maternal and fetal outcomes. Patient mortality was predicted by recourse to the APACHE II score.

Indications for ICU admission were divided into obstetric and non-obstetric causes. Obstetric causes were those unique to pregnancy or liable to occur within 6 weeks of delivery. Non-obstetric causes were those not specifically related in pregnancy.

Interventions provided by ICU physicians were classified into non-invasive and invasive. Those deemed non-invasive included insertion of arterial or central lines, blood product transfusion, use of continuous positive airway pressure (CPAP) ventilation, and use of inotropes. Invasive procedures included invasive mechanical ventilation, cardiopulmonary resuscitation (CPR), defibrillation, and haemodialysis.

Immediate and long-term complications of the mothers and neonates were assessed up to 6 to 8 weeks post-delivery. Maternal and perinatal mortalities were also calculated.

Data were entered manually into Excel and analysed using the Statistical Package for the Social Sciences (SPSS version 17, Chicago [IL], US). The data were compared with those from the results of a historical review in the same hospital (1989-1995, by Tang et al[2]) and a review in another regional hospital (1998-2007, by Leung et al[3]). Chi squared or Fisher's exact tests were used to compare proportions and Student's *t* test to compare continuous variables.

Results

In all, 67 relevant patients were admitted to the ICU and reviewed during the period of 1 January 2006 to 31 December 2010, which amounted to 0.23% of the total hospital maternities and 2.34% of all ICU admissions (Table 1). Their demographic features are shown in Table 2. The mean age of women at delivery was 34 (standard deviation [SD], 5; range,

入住深切治療部的產科病例：一個中心的經驗與更新

吳坤蒨、盧子健、曾憲雄、劉偉霖、梁永昌

目的：回顧2006至2010年入住一所分區醫院深切治療部的產科病例，並把她們與分別於1989至1995年在同一家醫院以及另一所分區醫院於1998至2007年的同類病人作比較。

設計：回顧性病例系列。

安排：香港一所分區醫院。

患者：2006年1月1日至2010年12月31日期間入住廣華醫院深切治療部的產科病人。

結果：2006至2010年期間共67名產科病人入住深切治療部（佔產科總額的0.23%和深切治療部入住率的2.34%），患病率高於其餘兩個同類型本地研究。在兩個同類型的本地研究中，大多數病人均為產後入住（n=65，97%），其中產後出血是最常見的原因（n=39，58%），其次是子癇前症或子癇症（n=17，25%）。本研究中，病人因胎盤前置而選擇剖腹產的明顯較多，而子宮切除術則較少。與兩個同類型的本地研究比較，本研究的病人入住深切治療部的時間較短（平均為1.8日），且較少進行侵入性程序，但產婦和新生兒的死亡率卻相近（分別為3%和6%）。

結論：產後出血和妊娠高血壓仍然是最常見入住深切治療部的原因。因胎盤前置而選擇剖腹產以及因子癇前症而進行早期積極干預後，最後導致入住深切治療部的有上升的趨勢。產婦死亡率仍然偏低，但沒有下降跡象。深切治療部的入住率本身可能不是一個有用的產科表現指標。

20-42) years. Thirty (45%) of the patients were of advanced maternal age (ie age at confinement of ≥35 years). The majority of them were Chinese (n=65, 97%), one was Filipino and one an Indonesian. Nine (13%) patients were visitors from mainland China. Seven (10%) were smokers, two (3%) drank alcohol regularly and two (3%) had a history of substance abuse. In all, 38 (57%) were nulliparous and six (9%) carried twin pregnancies. Most of the patients (n=61, 91%) were booked in our unit; 19 (28%) had three antenatal check-ups or less.

Among these 67 patients, 39 (58%) enjoyed good past health, and six (9%) had a BMI of more than 25 kg/m^2 at their booking visit. The most common co-existing diseases were gynaecological (n=11, 16%) and haematological (n=9, 13%). Their antenatal and peripartum risks are summarised in Table 3.

The mean gestational age at delivery was 37 (SD, 6; range, 27-41) weeks. Most of them were delivered by emergency caesarean section (n=34, 51%), including one transferred to us after delivery in the private sector. One patient remained undelivered and died antenatally. Placenta praevia and pregnancy-induced hypertensive disorders were the main indications for elective and emergency caesarean sections, respectively. Other indications are listed in Table 4.

The reasons for ICU admission and procedures undertaken therein are listed in Table 5. Most were admitted to the ICU postpartum (n=65, 97%) and for obstetric problems (n=58, 87%), of which postpartum haemorrhage (PPH) was the leading cause (n=39, 58%) followed by pre-eclamptic toxaemia (PET) or eclampsia (n=17, 25%). The mean duration of ICU stay was 1.8 (SD, 1.2; range, 0.5-10) days; four (6%) of the patients stayed for more than 3 days.

In all, 39 patients were admitted to the ICU due to a PPH, the mean estimated blood loss was 4852 mL. Major causes of PPH were related to placenta praevia (n=16), uterine atony (n=12), and perineal trauma (n=5). Blood products given included packed cells (mean, 12 units), platelet concentrate (mean, 5 units), fresh frozen plasma (mean, 7 units), and cryoprecipitate (mean, 1 unit). Three patients received recombinant factor VIIa (NovoSeven; Novo Nordisk A/S, Bagsværd, Denmark). Procedures to control PPH included compression sutures (n=10), uterine artery embolisation (n=9), insertion of a

TABLE 1. Intensive care unit (ICU) admission of obstetric patients

	Tang et al's study[2] *	Leung et al's study[3] *	Our study*	P value (our study vs Tang et al's study[2])	P value (our study vs Leung et al's study[3])
ICU admission rate (No./total maternities)	0.12% (49/39 354)	0.13% (50/37 505)	0.23% (67/28 976)	0.001	0.003
ICU utilisation rate (No./total ICU admission)	0.61% (49/8032)	0.65% (50†/7692)	2.34% (67/2868)	<0.001	<0.001
Duration of admission (days)	4.1 ± 2.3 (1-19)	2	1.8 ± 1.2 (0.5-10)	<0.001	-
Stay >3 days	23 (47%)	N/A	4 (6%)	<0.001	-
Admission status					
Antepartum	6 (12%)	11 (22%)	2 (3%)	0.052	0.001
Postpartum	43 (88%)	39 (78%)	65 (97%)	-	-
Elective admission (booked before admission to ICU)	N/A	6 (12%)	10 (15%)	N/A	0.649
Emergency admission	N/A	44 (88%)	57 (85%)	-	-

Abbreviation: N/A = data not available

* Data are shown as %, No. (%), or mean ± standard deviation (range)

† 6 Patients were less than 24 weeks of gestation

TABLE 2. Basic demographics

Demographics	Tang et al's study[2] *	Leung et al's study[3] *	Our study*	P value (our study vs Tang et al's study[2])	P value (our study vs Leung et al's study[3])
Maternal age at delivery (years)	32 ± 5 (21-42)	31 ± 6	34 ± 5 (20-42)	0.012	0.004
Advanced maternal age (≥35 years)	14 (29%)	9 (18%)	30 (45%)	0.076	0.002
Non-booked	15 (31%)	14 (28%)	6 (9%)	0.003	0.007
Primigravida	20 (41%)	N/A	38 (57%)	0.09	N/A
Twin pregnancy	N/A	N/A	6	N/A	N/A
Obesity (BMI ≥25 kg/m^2)	N/A	N/A	6 (9%)	N/A	N/A
Gestation at delivery (weeks)	36 ± 4	34 ± 9 (6-44)	37 ± 6 (27-41)	0.987	0.049
Previous caesarean section	7 (14%)	N/A	15 (22%)	0.272	N/A

Abbreviations: BMI = body mass index; N/A = data not available

* Data are shown as No (%) or mean ± standard deviation (range)

TABLE 3. Past health, antenatal and peripartum risks (more than one entry possible)

Health risk	No. (%)			P value (our study vs Tang et al's study[2])	P value (our study vs Leung et al's study[3])
	Tang et al's study[2]	Leung et al's study[3]	Our study		
Good past health	40 (82%)	43 (86%)	39 (58%)	0.008	0.001
Cardiovascular	6 (12%): Chronic rheumatic heart disease (n=4), chronic hypertension (n=2)	2 (4%): Chronic rheumatic heart disease (n=1), hypertension (n=1)	2 (3%): Supraventricular tachycardia (n=1), non-obstructive cardiomyopathy (n=1)	0.052	0.765
Neurological	2 (4%): Poliomyelitis (n=1), Segawa disease (n=1)	0	4 (6%): Epilepsy (n=3), myasthenia gravis (n=1)	0.65	-
Haematological	1 (2%): Aplastic anaemia	0	9 (13%): Thalassemia or anaemia (n=9)	0.031	-
Infection-related	0	5 (10%): Hepatitis B (n=4), pulmonary tuberculosis (n=1)	3 (4%): Syphilis (n=2), neck tuberculosis (n=1)	-	0.242
Gynaecological	0	1 (2%): Uterine fibroid	11 (16%): Fibroids or ovarian cysts (n=11)	-	0.011
Endocrine	0	0	4 (6%): Diabetes mellitus (n=2), thyroid disease (n=2)	-	-
Other	0	0	6 (9%): Psychiatric disease (n=4), asthma (n=1), renal disease (n=1)	-	-
Antenatal and peripartum risk					
Placenta praevia	2 (4%)	N/A	20 (30%)	<0.001	N/A
APH/abruptio placentae	5 (10%)	N/A	10 (15%)	0.454	N/A
PIH/PET	8 (16%)	N/A	15 (22%)	0.419	N/A
GDM	9 (18%)	N/A	22 (33%)	0.082	N/A

Abbreviations: APH = antepartum haemorrhage; PIH = pregnancy-induced hypertension; PET = pre-eclampsia toxaemia; GDM = gestational diabetes; N/A = data not available

TABLE 4. Mode of delivery

	Tang et al's study[2]	Leung et al's study[3]	Our study	P value (our study vs Tang et al's study[2])	P value (our study vs Leung et al's study[3])
NSD	13 (27%)	9 (18%)	9 (13%)	0.076	0.498
Instrumental delivery	2 (4%)	3 (6%)	6 (9%)	0.306	0.553
Elective caesarean section	3 (6%)	6 (12%)	17 (25%)	0.007	0.072
Emergency + crash caesarean section	30 (61%)	32 (64%)	34 (51%)	0.262	0.153
Undelivered	1 (2%)	0	1 (2%)	0.823	-
Indication for caesarean section					
Elective caesarean section					
Placenta praevia	3	N/A	13	0.04	N/A
Emergency + crash caesarean section (multiple entries)					
PIH (including PET/ eclampsia)	4	N/A	12	0.176	N/A
Placenta praevia	0	N/A	3	-	N/A
APH	5	N/A	5	0.603	N/A
Fetal distress	9	N/A	1	0.001	N/A
Breech	1	N/A	2	0.752	N/A
No progress in labour/CPD	8	N/A	6	0.229	N/A
Uterine scar related	1	N/A	3	0.477	N/A
Surgical/medical diseases	2	N/A	2	0.749	N/A
Obstetric emergency	1 (Scar rupture)	N/A	1 (Cord prolapse)	0.823	N/A

Abbreviations: NSD = normal spontaneous delivery; PIH = pregnancy-induced hypertension; PET = pre-eclampsia toxaemia; APH = antepartum haemorrhage; CPD = cephalopelvic disproportion; N/A = data not available

Sengstaken-Blakemore tube (n=6), and uterine artery ligation (n=2). There were 13 patients who underwent hysterectomy despite multiple other interventions and use of multiple uterotonics, and eight patients with PPH were complicated with disseminated intravascular coagulation, one had a ventricular tachycardia, and one had a urinary tract injury. One of the patients with a PPH and anaphylactic shock suffered a cavernous sinus thrombosis and a cranial nerve VI palsy, for which she received therapeutic doses of low-molecular-weight heparin. Another patient was admitted 2 weeks after delivery due to delirium secondary to sepsis.

There were 17 patients admitted to the ICU for PET or eclampsia (9 of whom had eclampsia) and were all stabilised in the ICU. Two patients had HELLP (haemolysis, elevated liver enzymes, low platelets) syndrome and two had hypertensive encephalopathy diagnosed on the basis of computed tomography. Other complications included acute pulmonary oedema (n=1), deranged renal function (n=3), deranged liver function (n=1), and aspiration pneumonitis (n=1). Another eight had persistent hypertension 6 weeks postpartum and were referred to physicians.

Regarding the 10 patients (15% of the cohort) admitted to the ICU for non-obstetric reasons, two had an epileptic seizure, three had cardiovascular problems (cardiomyopathy, heart failure, and pulmonary hypertension), and one each had renal disease, ethanol toxicity, acute pulmonary oedema, myasthenia gravis, and anaphylactic shock.

Invasive procedures performed in the ICU were CPR (n=2, 3%) and mechanical ventilation (n=7, 10%). Non-invasive procedures were blood product transfusions (n=36, 54%), central line insertion (n=18, 27%), arterial line insertion (n=24, 36%), use of inotropes (n=2, 3%), and CPAP ventilation (n=1, 2%).

The mean APACHE II score was 17 (range, 4-37) and the mean predicted mortality rate was 28% (range, 4-85%). The actual mortality rate in this series was 3% (Table 6). The maternal mortality ratio (MMR; actual/predicted mortality) was 0.11.

TABLE 5. Reasons for intensive care unit (ICU) admission

Cause	No (%) or mean ± standard deviation (range)			P value (our study vs Tang et al's study[2])	P value (our study vs Leung et al's study[3])
	Tang et al's study[2]	Leung et al's study[3]	Our study		
Obstetric	33	35	58	0.041	0.068
Non-obstetric	16	15	10	-	-
Obstetric causes*					
PPH	26 (53%)	19 (38%)	39 (58%)	0.581	0.031
Mean blood loss (mL)	3500 ± 1400 (1000-8500)	5200	4852 ± 4903 (300-25 500)	0.064	-
PPH with hysterectomy	22 (85%)	7 (37%)	13 (33%)	<0.001	0.792
PET/eclampsia	7 (14%)	7 (14%)	17 (25%)	0.145	0.132
Others	0	9 (18%)†	3 (5%)‡	-	0.017
Non-obstetric causes*					
Medical	7 (14%)	14 (28%)	8 (12%)	0.895	0.028
Anaesthesia	7 (14%)	0	1 (2%)	0.007	-
Surgical	2 (4%)	1 (2%)	0	-	-
Psychiatric	0	0	1 (2%)	-	-
Procedures in ICU					
Invasive					
Intubation	21 (43%)	29 (58%)	7 (10%)	<0.001	<0.001
CPR	0	0	2 (3%)	-	-
Non-invasive					
Blood product transfusion	N/A	-	36 (54%)	-	-
Central venous line insertion	N/A	26 (52%)	18 (27%)	-	0.005
Arterial line insertion	N/A	33 (66%)	24 (36%)	-	0.001
Inotropes	N/A	8 (16%)	2 (3%)	-	0.013
Non-invasive mechanical ventilation	N/A	3 (6%)	1 (2%)	-	0.184

Abbreviations: PPH = postpartum haemorrhage; PET, = pre-eclampsia toxaemia; CPR = cardiopulmonary resuscitation; N/A = data not available

* One patient in our study had both obstetric and non-obstetric indications; one patient had 2 obstetric indications

† Amniotic fluid embolism (n=3), ruptured ectopic pregnancy (n=2), peripartum cardiomyopathy (n=1), antepartum haemorrhage (n=1), septic abortion (n=1), and retained placenta with shock (n=1)

‡ Amniotic fluid embolism (n=1), intrapartum sepsis (n=1), and placenta praevia with retained placenta (n=1)

In our study period, there were two maternal deaths in the 28 976 maternities or 7 per 100 000 births, both in ICU patients. One was a patient who enjoyed good health but suspected to have pulmonary hypertension at 27 weeks of gestation, who rapidly deteriorated and died 1 day after admission. Her diagnosis was confirmed at postmortem examination. The other maternal death ensued in the postpartum period due to multi-organ failure and brain death, secondary to eclampsia and intraventricular haemorrhage.

Regarding these ICU admissions, three (5%) of the fetuses endured intrauterine death (IUD) and one (2%) whose neonate died (due to necrotising enterocolitis). The IUDs were associated with abruptio placentae, pulmonary hypertension, and severe pre-eclampsia with early intrauterine growth restriction.

Discussion

The health care system of Hong Kong aims to protect/improve maternal and child health, by means of antenatal, intrapartum, and postnatal services that are readily available at very low costs. Whilst the MMR fluctuated between 1.0 and 11.2 per 100 000 live births over the past 31 years,[4,5] the above-mentioned services have contributed to the decreasing and now very low maternal mortality rates.

Despite advances in obstetric care, the admission rate to the ICU had doubled compared with a decade ago (from 0.12% to 0.23%).[2] Whereas such ICU utilisation rates for obstetric cases were also higher compared with Tang et al's data[2] (2.34% vs 0.61%), nevertheless they were low compared to reports from overseas.[6,7] The rates were also higher than those reported by Leung et al (admission, 0.13%; utilisation, 0.65%).[3] One of the reasons for the rise in ICU admission rates was changes in patient allocation in our hospital, and over the Hong Kong Special Administrative Region. The number of beds in our ICU was reduced from 18 to 14 after the severe acute respiratory syndrome epidemic in 2003. The number of surgical admissions was also much lower than a decade earlier. Moreover, the number of trauma cases dropped significantly, since two other nearby tertiary hospitals became trauma centres. Changing attitudes of obstetricians and anaesthetists also contributed to the increase in ICU admission rate. Given the fact that our patients were most commonly delivered by elective caesarean section for placenta praevia, a proper preoperative management plan with a multidisciplinary approach involving anaesthetist, intensive care physician, and obstetricians should have been available before the operation, which included booking of the ICU bed. With the increasing trend of placenta praevia, it was expected that more and more patients would be admitted to the ICU electively for monitoring rather than any future active intervention. The shorter duration of ICU stays, compared with those detailed earlier by Tang et al,[2] is probably consistent with this trend towards elective admissions.

The mean age of our patients at delivery was higher than that in the patient series described by Tang et al[2] and Leung et al.[3] Indeed, patients of advanced maternal age were more likely to be admitted to the ICU when compared with our background population, though this was not shown for such ICU admissions reported by Selo-Ojeme et al.[8] Increasing maternal age implies that our patients were more likely to have co-existing diseases complicating pregnancy, as reflected by our data, even though the medical problems in question were generally mild and stable.

According to Tang et al's[2] and Leung et al's[3] reports about non-booked cases (NBCs), patients from mainland China used to be admitted via the emergency department very late when they went into advanced labour. As a result, potential or present obstetric complications were known to us only when they were admitted. With the commencement of the policy to allow these mothers to register and deliver in Hong Kong (since 2007), the number of NBCs decreased significantly, as did their number of ICU admissions.

In the literature there are conflicting data when parity is considered one of the risk factors for ICU admission. In our study, nulliparity was not related to ICU admission, which was also what Pollock et al noted.[6]

During our data analysis, twin pregnancy was more likely in our ICU patients compared with

TABLE 6. Morbidity and mortality

	No (%) or mean ± standard deviation (range)			P value (our study vs Tang et al's study[2])	P value (our study vs Leung et al's study[3])
	Tang et al's study[2]	Leung et al's study[3]	Our study		
Mean APACHE II score	13 (1-27)	16 ± 9 (Obstetric) 12 ± 9 (Non-obstetric)	17 ± 8 (4-37)	-	-
Mean predicted mortality rate	18%	N/A	28%	-	-
Maternal deaths	2 (4%)	3 (6%)	2 (3%)	0.749	0.425
Maternal mortality	5 per 100 000	8 per 100 000	7 per 100 000	-	-
Perinatal mortality	5 (10%)	4 (8%)	4 (6%)	0.400	0.667

Abbreviations: APACHE = Acute Physiology and Chronic Health Evaluation; N/A = data not available

the background population. However, such data cannot be retrieved from Tang et al's or Leung et al's reports.[2,3] Twin pregnancy is known to confer a higher risk of gestational diabetes, hypertension, premature delivery, operative deliveries, and postpartum complications (including PPH).[9,10] Our findings also supported the need of a specialised twin pregnancy clinic to look after this high-risk group.

Placenta praevia was the most frequent risk factor identified in our patient series, being much more common than in Tang et al's study.[2] Increasing popularity of evaluation by ultrasound has raised the detection rate of placenta praevia early in the antenatal period. All our patients with placenta praevia were delivered electively with proper preoperative arrangements. These entailed booking of ICU facilities, standby uterine artery embolisation, preparation of recombinant factor VIIa and Sengstaken-Blakemore tubes, and involvement of obstetric consultants to make decisions. One consequence was a significantly higher number of elective caesarean sections for placenta praevia compared with decades ago, though the overall section rate remained relatively stable.[11] This also correlated with placenta praevia being the commonest causes of PPH in our ICU patients.

As in Tang et al's[2] and Leung and et al's[3] studies, in our series admissions due to obstetric problems remained the main cause of obstetric ICU admissions. Postpartum haemorrhage was consistently the most common indication for ICU admission, which was also noted in Tang et al's series.[2] Although the mean estimated blood loss of our patients was apparently higher than that reported by Tang et al,[2] and abdominal delivery is known to increase the risk of hysterectomy following PPH,[12] the number of hysterectomies performed was significantly lower than before. The increasing use of compression sutures and uterine artery embolisation together with strategies to retain the placenta in cases of placenta accreta might account for the decreasing recourse to hysterectomy compared with 20 years ago.

The current series had more patients with pre-eclampsia or eclampsia admitted to the ICU than those reported by Tang et al,[2] although the difference was not statistically significant. As suggested by the National Institute for Health and Clinical Excellence guideline,[12] our management protocol was updated to incorporate the more liberal use of anti-hypertensives and magnesium sulphate. Our use of the modified early obstetric warning scoring system allowed early detection of potential complications to prevent poor obstetric outcomes. Intensive care is indicated in patients with severe hypertension, or moderate hypertension with symptoms of impending eclampsia or any suggestion of organ dysfunction. These innovations lead to the rising trend of ICU admissions to monitor for pre-eclampsia.

Active involvement of anaesthetists plays a role in the changing pattern of obstetric ICU admissions. There was a drastic reduction of admissions for anaesthesia-related causes compared with those reported by Tang et al.[2] Only one of our patients was admitted due to anaphylactic shock, which can be explained by the significant improvements in anaesthetic care and mechanical ventilation in our hospital. Invasive and non-invasive procedures (eg intubation and insertion of arterial and central venous lines) undertaken in the ICU were significantly fewer than decades ago, as most of them had been performed before admission to ICU by anaesthetists.

In our series, the mean duration of ICU stay was 1.8 days, which was shorter than 4.1 days reported in Tang et al's study.[2] The change in attitude and approach to management of both obstetricians and anaesthetists made ICU admission a more elective occurrence than before. As a result, patients admitted to the ICU tended to be more stable and fewer invasive interventions were warranted. These observations highlight the need for obstetric high-dependency units to cater for patients requiring more intensive care, but not to the extent of ICU support.[13]

When compared with the findings reported by Leung et al,[3] over the decades there was no significant increase in perinatal mortality, nor was there an increased rate of fetal loss when compared with our background population. Nevertheless, maternal mortality had not decreased. In our series, there were two maternal deaths that amounted to a mortality rate of 7 per 100 000 maternities. In Tang et al's series[2] the maternal mortality was 5 per 100 000, and in the UK it was reported to be 14 and 11 per 100 000 in 2003-2005 and 2006-2008, respectively.[14] However, these differences between series were not statistically significant.

One limitation of our study was that data collection from the computerised system might have omitted pregnant women admitted to the ICU from other specialties with diagnoses that were not obstetrically related. A second limitation was that the causes of maternal ICU admission may not relate directly to the causes of maternal mortality. For example, thromboembolism, one of the leading causes of maternal death in the UK, was not a major cause of ICU admission. In the UK, only 30% of such maternal deaths were in patients admitted to the ICU,[15] and on this issue there is no global consensus on the optimal indications for ICU admission. A third limitation was that the frequency of obstetric ICU admissions is also affected by the standard of obstetric care and the threshold admission criteria determined by obstetricians, anaesthetists, and intensive care physicians. As a result, ICU admissions may not truly reflect the standard of obstetric care.[16] A composite performance indicator of obstetric care by combining the frequency of ICU admission, numbers of emergency admissions and/or proportions of emergency/elective admissions, and proportions

having prolonged stays (eg >3 days) could be a more useful measure of the standard of obstetric practice in the future.

The APACHE II scoring system has been used as a quantitative predictor of mortality, mainly in medical and surgical patients admitted to the ICU using several physiological measures. Its potential has also been evaluated when applied to obstetric patients. According to different overseas reviews, it may overestimate risks in pregnant patients, as in them normal physiology can differ, often in subtle ways, and can undergo abrupt changes in various emergency conditions.[17,18] Thus, to date, there is still no proper screening system for obstetric emergencies. A specific scoring system for obstetric patients should be developed and warrants a large-scale international prospective study for this purpose.

The majority of patients discharged from our ICU enjoyed satisfactory recoveries in the puerperal period. In all, eight patients with hypertensive disorder in pregnancy had persistent hypertension for which they were referred for medical assessment. In our series, long-term outcome was not determined. Leung et al[3] found that women admitted to the ICU had lower mean scores for quality of life than normal Hong Kong females of similar age, but these authors commented that the relationship of low scores to the obstetric illnesses was unclear and might be resolved by long-term patient follow-up.

In some respects, Leung et al's study[3] also provided us with geographical controls. However, they included patients with gestational ages of <24 weeks, which complicated any comparison of risk factors. Moreover, being intensive care physicians they emphasised quality of life after discharge from the ICU. In contrast, we obstetricians looked for indicators to prevent/reduce maternal ICU admissions, as advocated in modern obstetrical care guidelines.

Conclusion

Our findings illustrate the various changes in ICU admission practice of obstetric cases in the last 20 years, and are comparable to those in other developed countries. Elective caesarean section for placenta praevia and PPH were the major reasons for ICU admission. More conservative management of placenta praevia and PPH appeared to reduce resorting to hysterectomy. These ongoing changes in practice may make emergency obstetric admissions to the ICU less likely in the future. Maternal mortality in our unit has remained low over the years, and can hardly be reduced any further. It is therefore more important to refine and improve obstetric practice to reduce maternal morbidity. The 'near-miss' in terms of obstetric ICU admission rates, together with measures targeting the duration of ICU stay, and a potential obstetric morbidity scoring system will no doubt better reflect our clinical performance standards in the future.

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How can the R.E.N.A.L. nephrometry scoring system aid management of a solid renal mass?

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ABSTRACT

Objectives: To investigate use of the R.E.N.A.L. nephrometry score in relation to the choice of treatment and postoperative complications for renal masses.

Design: Case series.

Setting: A tertiary referral hospital in Hong Kong.

Patients: Data of patients undergoing nephrectomy were collected retrospectively from a clinical database and analysed. A R.E.N.A.L. nephrometry score was allocated to each renal tumour by a blinded qualified radiologist, utilising computerised imaging systems. Patient demographics, choice of surgery (radical vs partial), and approaches (open vs minimally invasive) were analysed with respect to their R.E.N.A.L. score.

Results: In all, 74 patients were included during the study period, of which 38 underwent partial nephrectomy and 36 underwent radical nephrectomy. No differences between the groups were found with respect to patient demographics. There were significant differences between the partial and radical nephrectomy groups in terms of their mean nephrometry score (6.9 vs 9.3, P<0.001). The mean nephrometry sum was also significantly different in the open approach versus the minimally invasive approach in patients having partial nephrectomy (7.8 vs 6.0, P=0.001). There was no difference in the postoperative 90-day morbidity and mortality in the partial nephrectomy and radical nephrectomy groups.

Conclusions: The R.E.N.A.L. nephrometry score of a renal mass correlated significantly with our choice of surgery (partial vs radical) and our approach to surgery (open vs minimally invasive surgery), particularly in the partial nephrectomy group. It does not, however, correlate with postoperative complications. The nephrometry score provides a useful tool for objectively describing renal mass characteristics and enhancing better communication for the operative planning directed at renal masses.

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New knowledge added by this study

- We externally validated the use of the R.E.N.A.L. nephrometry scoring system to differentiate choice of surgery (radical vs partial nephrectomy) and approach (open vs minimally invasive), which was not shown in previous studies.
- We are able to qualify the weighting of individual parameters of the R.E.N.A.L. nephrometry scoring system on decision-making.

Implications for clinical practice or policy

- Application of R.E.N.A.L. nephrometry scoring preoperatively may be used as a guide to the complexity and choice of surgery in patients with small solid renal masses. It also serves as a tool for patient counselling, with reference to postoperative outcomes.
- Widespread use of this score may act as communication tools among specialists, such that direct comparisons of data and study results can be achieved.

Introduction

The annual incidence of renal cell carcinoma (RCC) in Hong Kong has increased steadily over the past 10 years reaching a rate of 5.9 cases per 100 000 inhabitants.[1] Surgical management remains the main treatment modality. With advances and ready availability of imaging, including screening by ultrasonography, more RCCs are diagnosed at an early stage (ie T1). The treatment modalities of these localised renal masses include radical nephrectomy or partial nephrectomy, in the form of an open or laparoscopic (with or without robotic-assisted)

R.E.N.A.L. 評分如何協助治理腎臟腫瘤？

王明皓、曹君彥、何崑崙、黃家榮、賴俊廷、文芷薇、姚銘廣

目的：探討R.E.N.A.L.評分與腎臟腫瘤的治療方法和術後併發症的關係。

設計：病例系列。

安排：香港一所提供第三層轉介醫療服務的醫院。

患者：從臨床數據庫取得曾進行腎切除的患者資料並進行回顧分析。由被設盲的放射科專科醫生利用電腦成像系統為每個病例的腎腫瘤進行R.E.N.A.L.評分，並分析患者的人口學資料、所選擇的手術方法（根治或局部切除）及模式（開放式與微創）與R.E.N.A.L.得分的關係。

結果：共分析了74名患者，其中38例接受腎部份切除術，另36例接受根治性腎切除術。兩組患者的人口學資料並無差異。根據患者的R.E.N.A.L.平均得分，進行局部和根治性腎切除術的患者有顯著差異（6.9比9.3，P<0.001）。在局部切除術的組別當中，R.E.N.A.L.平均得分在開放式手術與微創手術明顯不同（7.8比6.0，P=0.001）。術後90天的發病率和死亡率在腎部分切除術和根治性腎切除術組別之間並無差異。

結論：腎臟腫瘤的R.E.N.A.L.得分與選擇的手術方法（根治或局部切除）以及手術模式（開放式與微創）顯著相關，尤其是在腎部分切除術組別中，但R.E.N.A.L.得分與術後併發症無關。R.E.N.A.L.評分能客觀描繪腎腫瘤的特徵，並有助手術規劃。

approach, as well as other form of ablative therapy. Several large, retrospective studies and the recently published European Organization for Research and Treatment of Cancer randomised trial[2] have confirmed that the oncological outcomes of partial nephrectomy and radical nephrectomy are equivalent. The advantages of radical nephrectomy include better preservation of renal function and prevention of renal failure, lower cardiovascular morbidity, and better overall survival.[3] Although nephron-sparing surgery has slightly higher complication rate compared with radical nephrectomy,[4] most international guidelines recommend the former as the standard treatment for solitary renal tumours up to a diameter of 7 cm, whenever technically feasible.[5,6] In the US population, utilisation of such techniques has recently been reported to be low, partly due to lack of technical advancements and publicity about possible adverse long-term consequences.[7]

Decisions on the choice of surgery mostly depend on the size and location of the tumour. Other external factors, such as the surgeon's training, practice pattern, operating centre facilities, and hardware available, have a major impact on the choice of approaches and operation to be performed. In the presence of multiple treatment options, an objective way to describe the complexity of renal masses and to accurately assess the risks of postoperative complications is important for patient counselling and clinical decision-making. Scoring systems have therefore been developed and validated, and to date three are available for clinical use.[8-10]

Herein, we report our investigation into using the R.E.N.A.L. nephrometry score, as developed by Kutikov and Uzzo in 2009,[8] and its relationship to the choice of treatment and postoperative complications.

Methods

Data about patients having renal tumours treated by total nephrectomy in Queen Mary Hospital during the period of January 2006 to December 2011 were retrieved retrospectively from a clinical database and analysed. Patients who had not had preoperative computed tomography and three-dimensional reconstruction (available in the Queen Mary Hospital radiological department) were excluded, so as to standardise the radiographic characteristic of the renal tumours under study. This involved allocating a R.E.N.A.L. nephrometry score to each renal tumour utilising computerised imaging systems (GE Advantage Workstations; General Electric Healthcare, US) by a blinded qualified radiologist. The R.E.N.A.L. score was described in 2009 and includes the assessment of tumour (R)adius (size at the maximal diameter), (E)xophytic/endophytic properties, (N)earness of tumour to the collecting system or sinus, (A)nterior/posterior descriptor, and (L)ocation relative to polar lines. Standardised points (1-3 points per descriptor) were assigned onto each parameter, except the anterior or posterior component as originally described by Kutikov and Uzzo[8] (Table 1). Radius was measured as the maximum diameter of the tumour in centimetres and points were allocated as 1 (≤4 cm), 2 (>4 but <7 cm), and 3 (≥7 cm). Exophytic/endophytic points assigned were 1 when 50% or more of the tumour was exophytic, 2 when less than 50% was exophytic, and 3 when it was entirely endophytic. For non-spherical or asymmetrically located tumours, the predominant feature on any axis (not just the axial or coronal axis) was considered with reference to the renal cortex. The N component was measured as the distance of the deepest portion of the tumour to the collecting system and points were allocated as 1 (≥7 mm), 2 (>4 but <7 mm), and 3 (invading, touching or within 4 mm). Anterior/posterior location of the tumour was designated as a non-numerical suffix that describes the location of the tumour with respect to the kidney midline plane as assessed on axial images. When the mass was located at the tip of the renal poles or lay on the coronal plane where a meaningful anterior or posterior designation was not possible, the suffix "x" was assigned. The location score was assigned as the position of the mass relative to polar lines. The polar line was assigned as the plane of

the kidney above or below which the medial lip of parenchyma was interrupted by the renal sinus fat, vessels or the collecting system and best located in the coronal plane. Two polar lines were measured for each renal unit. The position of the renal tumour with respect to the polar lines was measured and a score allocated as described in Table 1. Nephrometry classes in terms of complexity were allocated as low (4-6), moderate (7-9), and high (10-12) based on the sum of scores allocated to each parameter. Patient demographics, including age, gender, preoperative renal function, and estimated glomerular filtration rate (eGFR) as calculated by Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equations were logged.[11] In addition, the American Society of Anesthesiologists (ASA) class,[12] chronic kidney disease stage, mode of surgery (radical vs partial), approaches (open vs minimally invasive surgery [MIS]), and ischaemic time were analysed with respect to their R.E.N.A.L. score and classes. The

TABLE 1. R.E.N.A.L. nephrometry scoring system[8]

	R.E.N.A.L. score		
	1 Point	**2 Points**	**3 Points**
(R)adius (maximal diameter in cm)	≤4	>4 but <7	≥7
(E)xophytic/endophytic properties	≥50%	<50%	Entirely endophytic
(N)earness of tumour to the collecting system or sinus (mm)	≥7	>4 but <7	≤4
(A)nterior/posterior	No points given. Mass assigned a descriptor of a, p, or x		
(L)ocation relative to polar lines	Entirely above the upper or below the lower polar line	Lesion crosses polar line	>50% Of the mass across polar line, or mass crosses the axial renal midline, or mass is entirely between the polar lines

TABLE 2. Basic demographics of partial nephrectomy and radical nephrectomy groups

Demographics	**No. of patients or mean ± standard deviation**		**P value**
	Partial nephrectomy (n=38)	**Radical nephrectomy (n=36)**	
Gender			0.980
Male	21	20	
Female	17	16	
Age (years)	58 ± 15	62 ± 14	0.207
Mean preoperative creatinine (mmol/L)	97 ± 64	158 ± 228	0.118
Mean preoperative eGFR (mL/min)	77 ± 20	65 ± 27	0.039
CKD stage			0.292
1	11	9	
2	12	16	
3	4	6	
5	0	3	
N/A	11	2	
ASA class			0.300
1	3	2	
2	28	21	
3	6	9	
N/A	1	4	
Pathology			0.072
RCC (clear cell)	24	28	
RCC (chromophobe)	1	2	
Oncocytoma	1	3	
AML	9	1	
Others	3	2	

Abbreviations: eGFR = estimated glomerular filtration rate; CKD = chronic kidney disease; N/A = not available; ASA = American Society of Anesthesiologists; RCC = renal cell carcinoma; AML = angiomyolipoma

90-day postoperative morbidity and mortality were retrieved according to the Clavien-Dindo system.[13] Continuous variables were analysed with Student's *t* test and categorical variables by the Chi squared and Fisher's exact tests. Any P value of <0.05 was taken as statistically significant. All data were analysed with the Statistical Package for the Social Sciences (Windows version 18.0; SPSS Inc, Chicago [IL], US).

Results

There were 74 patients included during this study period, of which 38 underwent partial nephrectomy (group 1) and 36 underwent radical nephrectomy (group 2). There were 41 males and 33 females. No statistical differences were found between the groups in terms of gender distribution, age, preoperative creatinine level, ASA class, or chronic kidney disease stage, although the mean eGFR was significantly lower in the radical nephrectomy group (65 vs 77 mL/min, P=0.039; Table 2). The final pathology of the majority of our patients was clear-cell RCC (n=52), and the remainder suffered from angiomyolipoma (n=10), oncocytoma (n=4), chromophobe RCC (n=3), and others (n=5). There were significant differences between the partial and radical nephrectomy groups in terms of their mean nephrometry score (6.9 vs 9.3, P<0.001). Individual parameters of the R.E.N.A.L. score in terms of radius (P<0.001), nearest to the collecting system (P<0.001), and locations relative to polar lines (P=0.017) were significantly different in the two groups, but there was no significant difference in terms of exophytic components or anterior/posterior location (Table 3).

Further analysis of the partial nephrectomy patients revealed that respective mean nephrometry scores of open versus MIS were 7.8 vs 6.0 (P=0.001), and in particular the nearest components were significantly different (P<0.001; Table 4). Such a difference was evident for the radical nephrectomy group. The overall 90-day morbidity in our study cohort was low, and included urinary leakage (n=1) and bleeding warranting embolisation (n=1) in the partial nephrectomy group, and intestinal obstruction (n=1) in the radical nephrectomy group. None of our patients received a postoperative transfusion. Mortality at 90 days in the radical nephrectomy group (n=1) was in a patient with metastatic RCC undergoing cytoreductive nephrectomy. There was no difference in postoperative 90-day morbidity and mortality between the two groups, even after stratification according to mean nephrometry score or with respect to different classes (Table 5). Ischaemic time was significantly higher for patients in higher nephrometry classes in the partial nephrectomy group (36 mins vs 51 mins vs 80

TABLE 3. Association between choice of surgery with nephrometry score and individual parameters

Variable	Mean ± standard deviation or No. of patients		P value
	Partial nephrectomy (n=38)	Radical nephrectomy (n=36)	
Nephrometry sum	6.9 ± 1.7	9.3 ± 1.5	<0.001
(R)adius			<0.001
1	33	5	
2	4	14	
3	1	17	
(E)xophytic/endophytic properties			0.858
1	16	16	
2	19	19	
3	3	1	
(N)earness of tumour to the collecting system or sinus			<0.001
1	11	0	
2	9	1	
3	18	35	
(A)nterior or posterior or x			0.515
a	12	14	
p	13	8	
x	13	14	
(L)ocation relative to polar lines			0.017
1	16	9	
2	9	3	
3	13	24	

mins, P=0.008; Table 6); all three patients with high nephrometry scores underwent open surgery using cold ischaemia with ice sludge surface cooling, thus explaining the difference in ischaemic time.

Discussion

The standard care of patients with a solid renal mass is excision. Partial nephrectomy has become

TABLE 4. Comparisons of surgical approaches in partial nephrectomy in relation to nephrometry score

Variable	Mean ± standard deviation or No. of patients		P value
	Open surgery (n=19)	Minimally invasive surgery (n=19)	
Nephrometry sum	7.8 ± 1.5	6.0 ± 1.5	0.001
(R)adius			0.597
1	16	17	
2	2	2	
3	1	0	
(E)xophytic/endophytic properties			0.132
1	5	11	
2	13	7	
3	1	1	
(N)earness of tumour to the collecting system or sinus			<0.001
1	2	9	
2	2	7	
3	15	3	
(A)nterior or posterior or x			0.189
a	4	8	
p	9	4	
x	6	7	
(L)ocation relative to polar lines			0.406
1	6	10	
2	5	4	
3	8	5	

TABLE 5. Complications

Complication	Partial nephrectomy	Radical nephrectomy	P value
None	26	31	
Conversion	3	0	
Bleeding require embolisation	1	0	
Urinary leakage	1	0	
Intestinal obstruction	0	1	
Others (ileus, AF, atelectasis, UTI, retention, gout, wound gapping)	7	4	
Total	38	36	0.243
Complication: Clavien grade			
0	28	30	
1	8	4	
2	0	0	
3	2	1	
4	0	0	
5	0	1	
Total	38	36	0.153

Abbreviations: AF = atrial fibrillation; UTI = urinary tract infection

TABLE 6. Operative parameters of partial nephrectomy stratified by nephrometry class

Parameter	Nephrometry class			P value
	Low (4-6)	Moderate (7-9)	High (10-12)	
Operating time (mins)	332	338	329	0.196
Blood loss (mL)	327	493	169	0.155
Intra-operative transfusion	0	1	0	0.630
Ischaemic time (mins)	36	51	80	0.008

the standard for T1a RCCs and more recent data support its use in larger tumours of up to 7 cm (ie T1b). Most internationally recognised guidelines support recourse to partial nephrectomy for T1a tumours whenever technically feasible,[5,6] as data suggest comparable oncological outcomes with more favourable outcomes in terms of risk of renal failure warranting dialysis, cardiovascular morbidity, and even mortality. Approaches to the management of a solid renal mass include consideration of whether to remove the whole kidney or resect the tumour only and achieve a margin clear of pathology. Secondary consideration is given to the approach of the surgery, be it a traditional open one or MIS (purely laparoscopic or robotic-assisted laparoscopic). Although the latter is technically more demanding and has more postoperative complications (blood loss, recourse to transfusions, and urinary leakage), many high-volume centres show favourable results in experienced hand.[14]

Many factors contribute to the choice of surgery and mode of approach. They include hospital infrastructures and patient volume, experience and training history of the relevant surgeons, patient preference, and most importantly tumour characteristics. Traditionally, clinical decisions were based mostly on the first of these factors, resulting in heterogeneous clinical choices and operative results. Even when only tumour characteristics were taken into account, there was wide heterogeneity in definitions, such as centrality or hilar location, and makes direct comparison of results between studies difficult and impractical.

The concept of nephrometry was proposed as a tool to objectively assess the complexity of a solid renal mass. To date there are three studies of largely nephrometric systems. They are the R.E.N.A.L nephrometry score proposed by Kutikov and Uzzo in 2009,[8] the preoperative aspects and dimensions used for an anatomical (PADUA) classification of renal tumours by Ficarra et al in 2009,[9] and the C-index method proposed by Simmons et al in 2010.[10] Most studies utilise the nephrometry scales in patients undergoing partial nephrectomy. The three methods made use of different parameters to assess the locations of the tumour in relation to various important structures of the kidney, and to predict the technical difficulty that might be encountered during nephron-sparing surgery of the target lesion. They have been reviewed as new tools that can guide surgical decision-making to improve academic reporting, risk assessment of complications, and prediction of functional outcomes.

The R.E.N.A.L. nephrometry score is one of the most studied scoring systems with numerous articles describing its use in clinical practice. The original description of the score was to set a standard reporting system, and its use suggested a relationship between renal mass anatomy, pathology, and prognosis.[8] Assessments of inter-observer variability confirm their reproducibility and inter-observer agreement was robust across specialties and levels of training.[15-18] Later studies showed that high R.E.N.A.L. scores were associated with higher major complication rates than those with intermediate or low scores.[15,19] Moreover, multivariate analysis revealed that prolonged operating time and high-complexity nephrometry score category were independent predictors of major complications.[19] Other reports demonstrated that the R.E.N.A.L. score correlated with both tumour grade (P<0.0001) and histology (P<0.0001), such that as tumour size increases there would be a greater probability of malignancy, including high-grade and clear-cell tumour on histology.[20,21] Nomograms have been developed based on study results to preoperatively predict the likelihood of malignant and high-grade pathology of an enhancing renal mass,[20] and such systems have been externally validated.[22] Other studies have demonstrated the association of nephrometry scores with use of ischaemia in partial nephrectomy,[15] warm ischaemia time,[23] choice of surgery (partial vs radical nephrectomy),[17,24,25] need of conversion to radical nephrectomy,[23] changes in the percent functional volume preserved and perioperative functional decrease,[26] long-term renal functional outcome following partial nephrectomy,[27] and postoperative urinary leakage.[28] In particular R.E.N.A.L. scores were higher in patients with partial nephrectomy who developed complications than in partial nephrectomy patients who did not (6.9 vs 6.0, P=0.02). No corresponding differences were found in patients having radical nephrectomy (P=0.99).[29] Other studies investigating their applications on robotic partial nephrectomy have shown incongruent results. In one study, Mufarrij et al[30] did not show the ability of this scoring system to predict perioperative outcomes in robotic-assisted partial nephrectomy. Others found significant correlations of the score with increased warm ischaemia time, blood loss, complications, and length of hospital stay[31,32] in patients undergoing robotic and laparoscopic partial nephrectomy. Clinical application of such anatomical classification systems has gained popularity in selecting cases suitable for alternative treatment of

small renal masses (such as by thermal ablation).[33] Available data so far show more evidence to support the use of this scoring system to make treatment decision more objective for renal masses.[34,35]

The results of our study clearly demonstrate a positive correlation of R.E.N.A.L. scores with the choice of nephrectomy (partial vs radical), in terms of the total summed scores and individual parameters including radius (size), location nearest to the collecting system, and relationship to polar lines. These findings support the idea that clinical decisions based solely on the size of tumours are oversimplified and other anatomical factors should enter overall considerations. We did not find significant correlations for other individual parameters, such as exophytic components and anterior/posterior location. This was in contrast to a previous study which espoused the relevance of such components to the choice of ablative therapy (radiofrequency, cryoablation, or partial nephrectomy) as originally described by Kutikov and Uzzo.[8] Another significant finding was the correlation between the score and the choice of approach in partial nephrectomy. It was shown that with an increase in mean nephrometry score or class, there was a trend towards choosing open rather than a MIS approach. This signifies that whenever partial nephrectomy is feasible, the open method is preferred for more complex tumours and that this practice can be based on an objective scoring system. However, this was not observed in our radical nephrectomy group, which echoed a previous study finding and like the original description aimed at partial nephrectomy (not radical nephrectomy). The significant correlation of R.E.N.A.L. class with ischaemic time may be useful to guide the choice of open approaches for partial nephrectomy in the presence of a renal tumour with a high score. This could facilitate the safe use of cold ischaemia so as to maximise preservation of renal function.

Our results were contrary to previous investigators reporting that the R.E.N.A.L. score was not associated with presence or severity of complications in both patient groups in terms of their mean score or class. This could be explained by the relatively low frequency of major complications in our study cohort (5.4%) and in the small sample size. With more prospective data available, we believe similar correlations of the score with the frequency of postoperative complications and perioperative outcomes would be revealed.

An inherent limitation of our study was that it was retrospective with respect to data collection and analysis. A second limitation was the exclusion of many patients due to unavailability of satisfactory quality images for the calculation of scores to make direct comparisons. A third limitation of the R.E.N.A.L. score per se was that the weight given to individual components contributed to the total score; numerical values were allocated arbitrarily and still await validation. Although ours is one of the few studies that demonstrate the association of this score and individual parameters on the choice of surgery rather than sole reliance on tumour size, we still have to define a single value in this scoring system below which we can confidently recommend partial nephrectomy. Moreover, other confounding factors such as the surgeon's experience and learning curve data were not available for analysis, and may heavily influence clinical decisions.

Future directions of studies and clinical utilisation of such a scoring system will aim to define different weightings for individual components contributing to the total score. Other studies may aim at enhancing the reproducibility and predictability of such tools, so that direct comparison can be made with other centres. Are we doing better than eyeballing when managing a solid renal mass? Maybe we are, but the use of the nephrometry score will enhance communication, documentation, and education for the coming younger generation of urologists. Lately, Simmons et al[36] have described the integration of the R.E.N.A.L. and C-index scoring systems as diameter-axial-polar nephrometry (DAP). Initial results demonstrate the DAP scoring system to be simpler, to decrease measurement error, to improve performance characteristic, to make interpretation easier, and to exhibit a clear association with volume loss and late function after partial nephrectomy. More mature data will allow us to choose the best tools for our patients.

Conclusions

The R.E.N.A.L. nephrometry score of a solid renal mass shows a significant association with our choice of surgery (partial vs radical) and our approach to surgery (open vs MIS), particularly in patients receiving partial nephrectomy. Its association with postoperative complications was not demonstrated in this study. The score provides a useful tool to define the character of a renal mass objectively, aid clinical decision-making, and enhance communication between professionals with respect to the management of solid renal masses.

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Current management of acute scaphoid fractures: a review

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ABSTRACT

The aim of this review was to present currently available evidence on the management of acute scaphoid fractures. Acute scaphoid fractures are usually diagnosed by a combination of history, physical examination, and radiography. However, in many patients scaphoid fractures are still missed. Thus, the general trend is to over-treat patients with a suspicion of scaphoid fracture. Many aspects of scaphoid fracture management are still controversial and different institutions vary in their approach.

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Introduction

Scaphoid fractures have been extensively investigated in the past. They are the most common type of carpal fractures and are usually found in young men,[1] accounting for 2 to 7% of all fractures, and 70 to 80% of carpal fractures.[2] Scaphoid fractures affecting the waist (70%) are the commonest type in adults, followed by distal pole fractures (10-20%), proximal pole fractures (5-10%), and tubercle fractures (5%).[2] Conversely, 52% of all scaphoid fractures in children involve the tubercle, 33% affect the distal third, and 15% affect the waist,[2] though this discrepancy may be partially accounted by the fact that children's scaphoids are not fully ossified in their proximal pole, making a waist fracture look like a proximal pole fracture. Scaphoid fractures are commonly prone to complications due to delayed treatment or misdiagnosis. Avascular necrosis is particularly common, with estimated rates of 13 to 50%.[3] Other complications such as nonunion, malunion, carpal instability, and radiocarpal arthrosis are also frequently seen. Thus, early diagnosis and treatment are critical for a better prognosis.

Acute scaphoid fractures can be difficult to diagnose. According to some studies, the prevalence of true fractures among patients with suspected scaphoid fractures may only be 5 to 10%.[1] Multiple radiographs may not be able to pick up all scaphoid fractures and consequently, clinicians attempt to avoid undertreatment by liberal use of cast immobilisation. However, overtreating patients results in a loss of work days and productivity and increased health care costs,[1] and it is conjectured that 76 to 100% of such cases undergo inappropriate initial immobilisation.[4]

Undisplaced scaphoid fractures are not benign injuries and warrant prolonged plaster cast immobilisation or early osteosynthesis. Clinicians should have a high index of suspicion and must be meticulous in studying the clinical examination findings and radiographs.

Anatomy

The scaphoid forms the bridge to the distal carpal row (trapezium, trapezoid, and capitates) and the proximal row (proximal pole to the lunate) by a ligamentous network including the scapholunate interosseous ligament and extrinsic palmar ligaments. The scaphoid can be simply divided anatomically into the proximal pole, the waist, and the distal pole. Its surface is mostly (80%) covered by articular cartilage.[5] The articular surfaces include the proximal pole articulation with the radius and lunate and the distal pole articulation with the capitate, trapezium, and trapezoid.

Being predominantly articular, the blood supply to the scaphoid has limited access. Branches from the radial artery (dorsoradial arteries) form arches at the dorsal wrist capsule and enter the scaphoid at its dorsal ridge. This provides 70 to 80% of the blood supply to the scaphoid.[3,5] The other 20 to 30% are supplied by the superficial palmar arch or branches of the radial artery that reach the distal palmar area of the scaphoid.[3,5] Thus, the proximal pole depends solely on intraosseous blood flow and fractures here have a high risk of osteonecrosis associated with a prolonged period of healing. An average of 3 to 6 months are required for healing in these fracture types and nonunion is quoted to ensue in 5 to 10%.[3] Additional nutrient arteries supply the distal pole via the area of the scaphotrapezium ligamentous attachment.

Biomechanics

The usual mechanism of injury is a forced dorsiflexion

wrist injury such as a fall on outstretched hand. Cadaveric studies have shown that fractures occur when the wrist is kept in 95 to 100 degrees of extension and a dorsiflexion load is applied to the radial half of the wrist with the radioscaphocapitate ligament kept as the fulcrum.[5] Failure in compression occurs on the dorsal side of the bone and failure in tension on the palmar side. Dorsal angulation of the fracture is caused by opposing rotational moments on the proximal and distal poles of the scaphoid. Furthermore, dorsal intercalated segmental instability (DISI) ensues if the proximal carpal row is in extension. Bending forces to wrist fractures are resisted by intact scaphoid-carpal ligaments.[6] Distal pole and tubercle fractures are due to direct impact and forced ulnar deviation causes avulsion fractures at radial collateral ligament attachments.

Assessment

Classical examination findings of tenderness at the anatomic snuffbox and the volar aspect of the distal tuberosity and positive scaphoid compression test (pain on axial compression of the thumb metacarpal) raise suspicions that warrant further investigation. A study by Unay et al[7] suggested that pain during thumb-index pinching (sensitivity 73%, specificity 75%, positive predictive value 96%, and negative predictive value 23%) and pain during forearm pronation (sensitivity 79%, specificity 58%, positive predictive value 82%, and negative predictive value 54%) aid the diagnosis of scaphoid fractures, but are absent in 27% of cases. Overall, the specificity for clinical examination shown in the literature was only 74 to 80%[3] and the mean positive predictive value was quoted to be only 21%.[8] Other physical findings that may help to diagnose scaphoid fractures include limitation in end arc of motion with flexion and radial deviation, and reduced grip strength.

Nonunion can be found in up to 12% in cases of missed scaphoid fractures.[3] Therefore, scaphoid fractures must be identified early and immobilised appropriately. Imaging techniques can aid in the diagnosis of occult fractures. Plain film radiography can detect a fracture in 70 to 90% of cases.[8] Four views are necessary: posterior-anterior (PA) wrist, lateral wrist with extended fingers, anterior-posterior (AP) wrist with flexed fingers (scaphoid lies parallel to the film with flexed fingers), and the wrist in 25 to 45 degrees supination with flexed fingers.[9] Neutral or ulnar-deviated PA films do not show waist fractures well, because the axis of the scaphoid is flexed towards the beam and the tubercle overhangs the body. Fractures of the dorsal sulcus are best demonstrated on a 45-degree PA oblique view, and proximal pole fractures on a 45-degree AP oblique view.[2] Scaphoid waist fractures are best seen on an ulnar-deviated PA view with 20 degrees of elbow flexion.[2] The semipronated oblique view visualises the waist of the scaphoid best, but multiple views such as PA, lateral and ulnar-deviated and clenched-fist views may be required to make a correct diagnosis.[9] Lateral X-rays may only detect tuberosity and distal third fractures,[10] but are also essential to show the carpal alignment and distal radioulnar joint alignment. A proper view should show a co-linear capitate and radius, with the pisiform located between the distal pole of the scaphoid and the body of the capitate.[3]

Other adjuvant imaging techniques may be required to diagnose scaphoid fractures. Computed tomography (CT) is usually used to identify fractures and nonunions and for preoperative planning, and it is better for detecting occult fractures of the cortex with a mean sensitivity of 94% and specificity of 96%.[1] It was found to have a mean negative predictive value of 99% in a study by Ty et al,[11] which means it is very unlikely to miss a scaphoid fracture. Furthermore, CT is readily available in urgent care settings and is more cost-effective than magnetic resonance imaging (MRI).

Magnetic resonance imaging has a mean sensitivity of 98% and specificity of 99%.[1] It can locate trabecular fractures and help identify other causes of wrist pain if a fracture is not found, besides helping to determine the vascularity of the proximal pole preoperatively. It is especially useful in diagnosing proximal pole fractures, which may develop avascular necrosis. Acute fractures show normal or decreased T1 and increased T2 intensity.[3] Nonunion and impaired vascularity are often seen with low T1 and T2 marrow signal intensity which correlates with poor healing.[3] Notably, MRI is more sensitive in detecting occult scaphoid fractures, with fewer false-positives than bone scans.[3] Thus, it can accurately exclude patients without scaphoid fractures and facilitate discontinuing immobilisation. For planning the management of cases of scaphoid nonunion, MRI can be used following internal fixation, as the bone marrow signal can be assessed even in the presence of a titanium alloy screw.[12]

Scaphoid fractures are commonly associated with injuries to the carpal ligament or triangular fibrocartilage complex, and reported in 35% of affected patients and intercarpal soft tissue injury may ensue

舟狀骨骨折治療的回顧研究

鍾培言、鄧育昀、馮國強

本研究綜合現有文獻對於舟狀骨骨折治療的方向。診斷舟狀骨骨折的方法包括病史、臨床檢查及X光檢查。可惜仍然有很多不能被正確診治的舟狀骨骨折病例。因此，現代舟狀骨骨折治療方法傾向對懷疑個案也作出治療。舟狀骨骨折治療的許多方面仍具爭議性，而每所醫院對舟狀骨骨折治療都有不同的看法。

in 86% of instances.[13] Usually these conditions can be treated conservatively as mild ligament tears heal without long-term complications. However, carpal ligament injuries may lead to symptomatic chronic carpal instability. Thus, surgical fixation and early mobilisation may be indicated in more severe cases. In the most serious cases, scaphoid fractures can constitute part of the abnormality in perilunate or lunate dislocations of the wrist. Identifying and assessment of these injuries can be performed with a wrist arthrogram or arthroscopy. Besides soft tissue injuries, distal radial fractures are also found quite commonly due to shared mechanisms of injury.

Classification

Herbert's classification system is the most well-known and commonly used, as it defines stable and unstable fractures. Type A fractures are stable acute fractures; type B are unstable acute fractures; type C are delayed unions (>6 weeks of plaster immobilisation), and type D are established nonunions (fibrous or sclerotic). Stable fractures include fractures of the tubercle (A1) and incomplete fracture of the waist (A2). Type B fractures are acute unstable fractures. These include subtypes B1 (oblique fractures of the distal third of the scaphoid), B2 (displaced or mobile complete fractures of the waist), B3 (proximal pole fractures), B4 (fracture dislocations), and B5 (comminuted fractures).[14]

Treatment

Treatment of acute scaphoid fractures is controversial and each centre has different criteria for conservative versus operative treatment. In patients with a suspected fracture but no obvious findings on X-rays, most centres advocate joint immobilisation before repeat imaging for reassessment at a later time. However, casting makes exclusion of fracture and determination of fracture union by follow-up X-rays more difficult, for which reason follow-up CT may be warranted. Fixation is suggested if the MRI shows a proximal pole fracture.[3] Since cartilage covers 80% of the scaphoid, no fracture callus can be made to stabilise the fracture site during healing[6] and thus rigid fixation is mandatory. Healing on the X-ray is inferred from disappearance of the fracture line, spot welding between fracture fragments, or callus formation. With these findings, immobilisation can be discontinued and patients can be allowed a gradual return to activities.

Treatment depends primarily on the location and degree of displacement. Distal pole fractures are usually due to avulsion of the scaphoid tuberosity or impaction of the distal articular surface. These fractures have a good vascular supply that enables rapid healing in 4 to 6 weeks with a short arm thumb spica cast.[5] Traditionally, undisplaced, stable waist fractures are treated in short- or long-arm casts. These often involve prolonged immobilisation of up to 12 weeks.[3] Union can be achieved in greater than 90% of affected individuals.[5] However, recent evidence suggests improved results with operative fixation. Prolonged immobilisation disrupts collagen homeostasis resulting in loss of normal connective tissue characteristics, allowing tendons to glide and the joint capsule to stretch.

Non-operative

Some studies suggest a further 6 weeks of immobilisation before offering operative fixation if at 6 weeks the CT shows an unhealed fracture.[3] Others suggest that most fractures of the scaphoid waist unite after 8 weeks of immobilisation but may require as long as 12 weeks.[15] Overall scaphoid waist fractures can unite satisfactorily in 85 to 95% of patients.[16] Scaphoid fractures are generally immobilised in a scaphoid cast (proximal phalanx of thumb in palmar abduction leaving the interphalangeal joint free) or a Colles' cast (exposing the thenar eminence and leaving the metacarpophalangeal joint free). Pinch grip function is impaired in scaphoid casts; the Colles' cast allows for greater overall range of thumb movement and improved function.[17] The fine pinch grip of the thumb should be preserved as much as possible, for which Colles' casting rather than scaphoid casting offers better preservation of function.[17] However, there are no data on the long-term results of fracture healing following these two types of casting.

The wrist position during immobilisation has also been investigated. Hambidge et al[18] showed that the frequency of nonunion was not influenced by the position of immobilisation (P=0.46) and 108 of 121 fractures united after 12 weeks of immobilisation. However, wrists immobilised in 20-degree flexion results in less extension at the 6-month follow-up.[18] A possible explanation was that immobilisation in flexion may have produced increased flexion stress on the fracture, causing a humpback deformity, which restricts wrist extension and causes persistent pain.[18] An alternative explanation for restricted extension could be related to soft-tissue injury, joint adhesions, or contracture of the palmar capsule at the wrist.[18] Immobilisation in a Colles' cast with the wrist in 20-degree extension is therefore recommended.[18]

Long-arm versus short-arm casting is controversial. Biomechanical studies in cadavers show fracture site motion during forearm rotation.[5] Forearm rotation leads to excessive scaphoid fracture motion, which may impair bone healing. Excessive motion is an indication for long-arm casting to restrict forearm rotation and to reduce the associated displacement of bone fragments. Displacement of more than 1 mm is associated with instability and is an indication for open reduction and internal fixation.[19] A cadaveric study

on scaphoid waist fractures by Kaneshiro et al[20] showed that significant fracture site motion could occur with forearm rotation in a short-arm thumb spica cast. Some forearm rotation may even occur when long-arm casting is used, but the displacement should be less than 0.5 mm.[20] Thus, long-arm casting is recommended.

As mentioned above, most studies suggest immobilisation for 8 to 12 weeks for scaphoid waist fractures.[15-18,21] Geoghegan et al[15] showed that 89% of undisplaced scaphoid fractures achieved union by 4 weeks and mobilisation could begin at that time. Allowing mobilisation with a wrist splint at week 4 can reduce the period of disability associated with nonoperative treatment.[15] Böhler et al[9] showed a 96% healing rate in 580 undisplaced scaphoid waist fractures with 6 weeks of immobilisation with a simple unpadded dorsal fist plaster splint that includes the thumb. The hand needs to be kept in neutral position when using the dorsal plaster splint.[9]

Nonoperative treatment is successful in achieving union but there are disadvantages of immobilisation, namely stiffness, diminished grip strength, and delayed return to work. Pseudoarthrosis ensues in approximately 4% of patients who only have casting, and is usually associated with vertical oblique fracture patterns (due to tilting and shearing forces) and diastasis between bone fragments.[9] Young and active patients are unlikely to tolerate several months of immobilisation due to the pressures of work or athletics. Currently, therefore, there is a trend towards operative management to reduce the number of days of inactivity.

Operative

In theory, early internal fixation has the benefits of early return of wrist movement, a higher rate of union, an early return to work and sport, and avoiding the need for a plaster cast. Reduction of the fracture in anatomical alignment is vital for good results. If reduction cannot be achieved by closed means, open reduction is necessary. Usually simple hyperextension of the wrist can achieve good reduction. In addition, Moser et al[22] suggested having the arm in extension during surgery to maintain the reduction. Percutaneous fixation of the fracture limits the risk of devascularising fracture fragments and protects the ligaments and volar capsule. However, for percutaneous fixation to be feasible, the fracture must not be displaced or reducible by closed means. On the contrary, there is no controversy about treating displaced scaphoid fractures by open reduction and internal fixation.[5] Surgical stabilisation allows the patient to perform early range of motion exercises and avoids prolonged immobilisation.

In the literature, evidence in favour of surgery is not overwhelming. A meta-analysis by Bhandari and Hanson[23] showed that internal fixation resulted in a significantly earlier return to work (by 8 weeks) as compared with casting. However, both methods did not differ in terms of outcomes such as grip strength (P=0.24) and range of motion (P=0.67).[23] Furthermore, the risk of nonunion was also found to be similar (P=0.28).[23] Similarly, Saedén et al[21] showed that a follow-up period of up to 12 years after the fracture revealed no difference in pain or discomfort between the operative and conservative treatments. Dias et al[24] had similar results in terms of grip strength and range of movement after follow-up for 93 months. However, McQueen et al[25] showed that percutaneous screw fixation attained quicker union (9 vs 14 weeks, P<0.001) for treatment of Herbert types B1 and B2 fractures of the scaphoid waist.

The two usual approaches for percutaneous fixation of scaphoid fractures involve volar traction assistance and the dorsal minimal incision (manual reduction with a guidewire as a joystick technique or arthroscopy-assisted reduction). In the volar technique, the wrist is extended over a towel roll to allow proper insertion of the guidewire. Yip et al[26] suggested the 45-degree supination oblique view when determining the length of the screw and avoiding over-penetration into the radioscaphoid joint space. The headless screw must be fully buried beneath the articular cartilage of the proximal scaphoid, so as to avoid radioscaphoid impingement. Scaphoid fixation is best accomplished with the longest screw placed in the distal scaphoid poles.[6] Bone density is greatest in the scaphoid poles, where it provides the best fixation.[6] Fractures of the distal two thirds can also be approached volarly, as this approach avoids injury to the dorsal blood supply. The volar technique is contra-indicated in proximal pole and oblique fractures, as the screw cannot cross the fracture line perpendicularly to obtain adequate compression and purchase.[27] This leads to displacement of the fracture. During surgery, the scaphoid is in a flexed posture relative to the longitudinal alignment of the distal radius. From the volar approach, the proximal point to aim at is the proximal ulnar corner of the scaphoid at the insertion of the scapholunate ligament.[28] The starting point of the surgery is at the scaphotrapezial joint through the proximal thenar muscles. Besides a small terminal branch of the radial nerve, the operation is at a safe distance from the median nerve motor branch and from the radial artery. The drawback of volar surgical approaches is the difficulty in obtaining fracture reduction, which may therefore result in nonunion of proximal scaphoid pole fractures.[6] The trapezium is in a position that blocks wire placement volarly, and therefore placing a guidewire along the central scaphoid axis is difficult such that the screw can also penetrate the joint.[6]

For the dorsal approach, the distal point aimed

at is the centre of the scaphotrapezial joint or the base of the thumb. Thus, this allows for a more central placement in the distal pole.[28] The dorsal approach provides direct unobstructed access to the proximal pole permitting the placement of a central axis guidewire for screw implantation. There is better fracture fixation as the purchase of the screw threads in the proximal fragment tends to be greater.[29] However, the disadvantages of this technique include poor exposure to the distal third of the scaphoid, damage to the articular cartilage of the proximal pole of scaphoid, potential entrapment of the extensor tendons, damage to the dorsal ligaments, and risk of vascular injury.[29,30] Moreover, to insert the screw through the most proximal part, the wrist has to be fully flexed during the procedure.[29] Flexing the wrist may cause the distal fragment to adopt a flexed posture and cause the proximal fragment to follow the lunate into an extended posture, producing the hump-back deformity.[29] Distal pole fractures can present technical difficulties for insertion of a volar screw perpendicular to the fracture line and are therefore best suited for fixation using the dorsal fixation technique.[27]

Arthroscopy can assist fracture reduction, and real-time mini-fluoroscopy can guide the dorsal percutaneous insertion of a headless compression screw.[6] Arthroscopic examination can also permit assessment of concurrent ligamentous injuries and demonstrate osteochondral fragments at the midcarpal row.[6] Thus, arthroscopic-assisted surgery can treat both scaphoid fractures and carpal ligament injuries.[31] Arthroscopy also preserves the key ligaments and blood supply, allowing for immediate hand rehabilitation.[32]

Complications

Up to 20% of patients may endure residual pain despite a normal grip strength and wrist movement after surgery.[33] These persistent symptoms can be due to intra-operative articular cartilage damage. Damage affects the distal scaphoid-radial styloid joint first, and later progresses to the scaphocapitate and capitolunate joints. Osteoarthritis occurred in 5% of patients with a history of a scaphoid fracture despite normal healing,[34] but usually did not present until several decades after injury. The opening of the scaphotrapezial joint for screw insertion during surgery may result in the development of osteoarthritis.[21]

Malunion of the scaphoid may produce a flexion (humpback) deformity with ulnar deviation and pronation of the distal fragment. Flexion deformity within the scaphoid causes loss of extension at the radiocarpal and midcarpal joints. Amadio et al[35] showed that only 27% of patients with interscaphoid angles of >35 degrees had satisfactory results in terms of pain, function, movement, and strength. This contrasts with 83% of the patients having satisfactory results with interscaphoid angles of <35 degrees.[35]

It is accepted that for a scaphoid fracture, 6 months must elapse before a diagnosis of nonunion can be made. Such patients endure pain and poor function; in 35% lateral wrist X-rays yielded a humpback deformity (due to flexion angulation between the proximal and distal scaphoid poles) of patients,[4] and 42% showed DISI.[4] In a review of 104 patients with symptomatic nonunion, all of them developed osteoarthritis.[36] Fibrous union is visualised as irregularity at the fracture line, while in pseudoarthrosis the two bone halves move independently causing articular damage to the radial facet.[33] Displacement of the nonunion with the incongruent cartilaginous surfaces and carpal instability also contributes to the development of osteoarthritis.[4] Many now advocate internal fixation and the use of bone grafting for the treatment of established nonunion. Bone healing usually occurs (in about 75% of cases) but there may be persistent humpback deformity (16%), associated DISI deformity (12%), and osteonecrosis (4%).[4] Nevertheless, late osteoarthritis is inevitable and cannot be avoided, even by this operation.[33] This is an expected consequence of the disease process due to cartilage destruction. The main predictor of healing or failure was the time elapsed between the initial fracture and the treatment of the established nonunion. A delay of 5 years or more would decrease the success rate to only 62%.[4]

Complications of open repair include hypertrophic scarring, avascular necrosis, carpal instability, donor site pain, bone graft infection, screw protrusion, and reflex sympathetic dystrophy.[6,28] Due to the cartilaginous surface and fracture healing being an intraosseous process, open fixation of a fractured scaphoid may further jeopardise the blood supply of the scaphoid and drain away the fracture haematoma.[26] The radiocarpal ligaments may also be damaged during open surgery.[26] These complications may be avoided using a minimally invasive arthroscopic approach.[6]

Our centre's practice

When a patient is admitted with the clinical suspicion of a scaphoid fracture (mechanism of injury, tenderness at the anatomical snuffbox) but no obvious fracture line seen on X-rays, we provide the patient with a short-arm scaphoid cast and then order a CT. The CT includes a coronal view to better screen for any fracture. If no fracture is evident, a soft splint is given for pain relief.

For an undisplaced non-comminuted waist fracture, we offer conservative treatment with a short-arm scaphoid cast for 6 weeks with interval X-ray monitoring. Casting is kept for up to 4 to 8

weeks if the fracture line is still seen before surgery is considered. We rarely perform surgery in this patient group because we attained a 95% union rate in compliant patients. In distal pole fractures, the healing is generally quite good and we rarely resort to excision.

We recommend surgery for all other types of fracture alignment to prevent nonunion. We generally use Herbert screws or cannulated screws, subject to the surgeon's preference. We almost always use the percutaneous approach unless the reduction cannot be obtained well. We use a volar approach antegrade from the scaphoid tubercle as we try to avoid the dorsal approach to prevent cartilage injury. We, however, do use the dorsal approach for proximal pole fractures. The success rate is about 95% for percutaneous fixations and 85 to 90% for open reductions.

For rehabilitation, we allow free mobilisation on postoperative day 1 in waist fractures if the fixation is rigid; we keep a slab for 2 weeks if the fracture fixation is doubtful. We nevertheless allow supervised gentle mobilisation for these fractures. In proximal pole fractures, the purchase is usually doubtful and we immobilise the wrist for 4 weeks.

In cases of nonunion, a plain MRI is helpful for the assessment of avascular necrosis as these conditions may require additional procedures such as grafting. This condition is found in our hospital 12 to 18 times a year, and is always due to late referrals or improper primary management including casting for displaced waist fractures.

Conclusions

The current literature indicates no standard treatment for scaphoid fractures. Different centres have different approaches to the treatment of scaphoid fractures and the evidence on which they rely is controversial. However, the current trend is to treat scaphoid fractures operatively, so as to limit the number of days away from work and to allow patients to regain function sooner.

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The principle of assessing mental capacity for enduring power of attorney

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A B S T R A C T

With Hong Kong's rapidly ageing population, increasing numbers of people now have some form of cognitive impairment. Enduring power of attorney is a legal instrument that can allow individuals to manage their financial matters if they subsequently become mentally incapacitated. The law requires that the mental capacity of the individual making an enduring power of attorney should be certified by a registered medical practitioner and a solicitor. This paper discusses the principles involved in the assessment of mental capacity for making an enduring power of attorney and uses this example to illustrate various important considerations in the formal assessment of mental capacity.

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Introduction

Case vignette

A 75-year-old man is diagnosed with mild dementia. His score in the Mini-Mental State Examination is 23 out of 30. He is a retired civil servant and lives with his wife, who is physically frail. The couple own the property they are living in and depend on his pension. He is worried that his cognitive function will deteriorate further and hopes that his only son will manage his pension and property when he becomes mentally incapable. How should his medical doctor advise him?

An enduring power of attorney (EPA) is a legal instrument under the Hong Kong Enduring Powers of Attorney Ordinance (Cap. 501)[1] that allows the donor (the person who wishes to give his or her power of attorney to someone) to appoint an attorney(s) to take care of his or her financial matters in the event that he or she subsequently becomes mentally incapacitated.[2] Conventionally, a power of attorney is only made by individuals who are mentally capable and the power of attorney lapses if the donor subsequently becomes mentally incapable. In contrast, an EPA is a special type of power of attorney that continues to have effect after the donor becomes mentally incompetent.[2] Its key advantage is that it allows individuals to extend their autonomy and to choose someone to look after their affairs if the donor becomes incapable of doing so in the future. For example, if a donor has a known set of values, an EPA can allow a substitute to make decisions based on his or her values. Therefore, an EPA is regarded as a useful tool for extending autonomous decision-making power in the event of mental incapacity.

With Hong Kong's rapidly ageing population, the rates of cognitive impairment and dementia are increasing.[3] Because the elderly in Hong Kong tend to have accumulated their own wealth and assets, the utility of an EPA in the context of elderly care has increasingly been recognised. Recently, the Hong Kong Mortgage Company Limited launched an initiative to encourage existing borrowers and new applicants to consider arranging for EPAs to handle their financial transactions.[4] Thus, EPAs are expected to become more popular as people become more aware of their use.

The donors of EPAs are typically persons who are concerned that in the event that mental capacity deteriorates in future, they may be subject to undue influence and/or impaired judgement. To safeguard against abuses of EPAs, Section 5(2) of the Enduring Powers of Attorney Ordinance (Cap. 501) requires a registered practitioner and a solicitor to certify that the donor is mentally capable of executing (making) an EPA.[1] This paper discusses an approach to assessing an individual's mental capacity in making an EPA. We hope that this approach will also serve as a useful framework for formal assessments of mental capacity.

Assessing mental capacity in making an enduring power of attorney

Mental capacity denotes the ability to make decisions. It is pivotal in balancing the duty to maximise the autonomy of the vulnerable individual. Safeguarding the autonomy of a mentally capable person is as important as protecting the rights of a

簽立持久授權書時的精神行為能力的評估原則

雷永昌、趙宗義、高淑芬、林翠華

隨着香港人口急速老化，越來越多人有某種形式的認知功能障礙。持久授權書是一份法律文件，如果授權人其後變為精神上無行為能力，仍能根據其意願管理財產。法律規定，簽立持久授權書者必須由一名註冊醫生及一名律師核證其當時具精神上行為能力。本文討論了簽立持久授權書時的精神行為能力的評估原則，並利用例子說明正式評估精神行為能力時各種重要的考慮因素。

mentally incapable person. Although legally, a single test is used for mental capacity versus incapacity, the consequences of its certification can be very different. If the patient is found incapable of making a decision, protection is needed. The best interests approach or proxy consent from a legal guardian who has been vested with appropriate powers under the Mental Health Ordinance may apply.[5] However, if the patient is certified to be mentally capable, he or she will be responsible for his or her behaviour or choices. Therefore, assessment of mental capacity must be performed with great care.

Mental capacity should be distinguished from functional or physical capacity, as impairment leads to different kinds of interventions. For instance, a donor who has a stroke may be mentally capable but physically unable to sign an EPA because of limb weakness. Section 5(2)(b) of the Enduring Powers of Attorney Ordinance (Cap. 501) provides that donors can ask others to sign on their behalf, if they cannot sign because of physical disability.[1]

Section 5 of the Enduring Powers of Attorney Ordinance (Cap. 501) does not impose any restriction on the solicitors or registered medical practitioners who can carry out the certification. However, the certifying practitioners should be aware of the relevant legal criteria according to the requirements specified in Section 2 of the Enduring Powers of Attorney Ordinance (Cap. 501). In complex cases or when mental illness is present, it may help to seek advice from a psychiatrist.

Preparing for formal assessment of mental capacity

The preparatory work before an assessment is important but can be very variable, depending on the complexity of the case or the EPA. Before the assessment, it is essential that the practitioner gathers all the necessary information relevant to the decision. In general, the decisions to be made in an EPA include assigning the attorney and stating their powers. Understanding the health condition of the donor can help facilitate the interview and assessment arrangements. If the donor has difficulty communicating, the certifying practitioner should ensure that suitable communication aids are available. For example, if the donor has a hearing impairment or speaks a dialect, a hearing aid or interpreter may be needed. If the donor has a mental disorder, prior psychiatric assessment can help provide information on his or her mental capacity and stability. Additional information from a reliable informant may also be needed to complete the psychiatric assessment. However, caution is necessary in regard to confidentiality and any potential conflicts of interest relating to the EPA.

The EPA to be executed should be explained clearly to the donor before the mental capacity assessment. A solicitor who has a good understanding of EPAs is usually the most appropriate person for this job. During the mental capacity assessment, the donor may forget relevant information about the EPA that may require re-explanation. Therefore, it is more expedient for the solicitor and the registered medical practitioner to assess the donor's mental capacity on the same occasion rather than having separate interviews.

Mental capacity is task-specific, which means that the mental capacity required to create an EPA is not the same as the capacity needed to manage one's property and financial affairs. An individual's mental capacity should not be judged based on his or her age and/or appearance. Mental capacity is also time-specific, focusing on the particular time when a decision is made or has to be made. These characteristics of mental capacity are generally accepted in the literature[6,7] and endorsed by courts.[8] The time and task requirements for making an EPA are further discussed in the coming sections.

Some practitioners may wish to assess the donor's general cognitive function, which is generally measured with the Mini-Mental State Examination (MMSE). Gregory et al[9] found that the degree of cognitive impairment as measured by the MMSE correlated significantly with the capacity to make an EPA as assessed by a structured interview. However, given the complex nature of mental capacity in making individual EPAs, there is no literature supporting the isolated use of the MMSE or similar measures for assessing mental capacity. These kinds of cognitive assessment scales cannot by themselves prove an individual's mental capacity nor replace clinical judgement.

When the assessment should be performed

There are different legal requirements for registered medical practitioners and solicitors regarding the time of mental capacity certification in relation to the execution of an EPA. Section 5(2) of the Enduring Powers of Attorney Ordinance (Cap. 501) requires that an EPA should first be signed before a registered medical practitioner and that the donor

and the solicitor should then sign the EPA within the next 28 days.[1] Simultaneous legal and medical assessment at the time an EPA is made can be costly and, in some circumstances, too onerous for some individuals, such as an elderly person or someone with mobility problems. The "28 days" provides a degree of flexibility and facilitates completion of this legal instrument.

It is worth noting that compliance with these time requirements does not necessarily prevent others from challenging the validity of an EPA in the future. If an EPA is signed by a donor who lacks sufficient mental capacity, it will be void and of no effect. The mental capacity of a donor, especially if he or she is a frail elderly person, can fluctuate for a variety of reasons, including delirium and mood change. If there is reason to believe that a donor's mental capacity may fluctuate or deteriorate, the mental capacity assessment by the registered medical practitioner should be done simultaneously with the certification by the solicitor at the time of execution.

Assessment of tasks required in making an enduring power of attorney

The legal test of mental incapacity for the creation of an EPA is defined under Section 2 of the Enduring Powers of Attorney Ordinance (Cap. 501)[1] and Section 1A of the Powers of Attorney Ordinance (Cap. 31).[10] In essence, the certifying practitioner should be satisfied that: the donor understands the implications of an EPA, is capable of making the decision, and is able to communicate his or her wish to grant an EPA.

It is useful to note how the courts have assessed mental capacity for EPA. Although there is no case law in Hong Kong, in the United Kingdom, the degree of understanding required to create an EPA was considered in *Re K, Re F*.[11] According to this ruling, the donor should understand the following four pieces of information:

- if such be the terms of the power, that the attorney will be able to assume complete authority over the donor's affairs;
- if such be the terms of the power, that the attorney will in general be able to do anything with the donor's property which the donor could have done;
- that the authority will continue if the donor should become mentally incapable; and
- that if he should be or becomes mentally incapable, the power will be irrevocable without confirmation by the court.

These criteria are considered to be the basic requirements for confirming that the donor understands the nature and effect of the EPA.[7,12] There are several considerations in applying this test. First, the complexity of each EPA case is different. Based on these legal criteria, practitioners should prepare their own questions for individual EPA donors. Second, the practitioner should avoid only asking closed questions, such as "Do you understand that your attorney will be able to assume complete authority over the donor's affairs?" In this case, a "Yes" or "No" reply would provide little information for establishing mental capacity. The practitioner should try to ask open questions such as "What will your attorney do with your affairs?" The donor's answers should be recorded verbatim. Third, it is possible that the criteria are too general and do not cover the modifications in a particular EPA. For example, the donor may impose restrictions on the EPA, such that the attorney can only manage specific affairs such as the mortgage on the donor's property. In which case, the practitioner should specifically clarify that the donor understands the restriction on the attorney's specific powers (authorities) and their effects.

More importantly, the *Re K, Re F* test does not directly address whether the donor is mentally capable of making the decision to create an EPA as required in the Enduring Power of Attorney Ordinance (Cap. 501). There is no consensus on how the donor's answers should be analysed to determine or establish his or her mental capacity in making an EPA. One useful approach can be found in the literature, where mental capacity is conceptualised as consisting of four decision-making abilities. These are: the ability to understand relevant information, the ability to appreciate the situation and its consequences, the ability to reason about different options, and the ability to communicate a choice.[13] The applicability of assessing these decision-making abilities has been evaluated in the local population in relation to various decisions.[14,15] The certifying practitioners can evaluate and comment on the performance of the donor in relation to each decision-making ability, which can then be used to support the assessment of mental capacity.

Forming conclusions on mental capacity

There are no hard and fast rules for making a definite conclusion on mental capacity. In the context of medical treatment, the determination of mental capacity has been described as "a societal judgment about the appropriate balance between respecting the patient's autonomy and protecting the patient from consequences of a bad decision."[6] This balancing process is also required in the creation of an EPA, as the required level of performance in assessing each decision-making ability is at once a value judgement. If the consequences of a donor's decision to make an EPA are very serious or risky, a higher level of decision-making abilities will be required. Therefore, the required standard for mental capacity is context-dependent and should be tailored to the needs of the

individual case.

Documenting the assessment

The certification of mental capacity requires the legal and medical practitioners to duly sign a prescribed form under the Enduring Powers of Attorney (Prescribed Form) Regulation (Cap. 501A).[16] The certifying practitioner should write his or her full name, address, and the date appropriately on the form. However, the certifying practitioner should also be prepared to produce the evidence used to establish the donor's mental capacity some years later in case of future dispute or challenge in court.

One good example can be found in testamentary capacity where certification of one's mental capacity is not mandatory. In *Kenward v Adams* (1975), Justice (later Lord) Templeman stated that:

> *In the case of an aged testator or a testator who has serious illness, there is one golden rule which should always be observed, however straightforward matters may appear, and however difficult or tactless it may be to suggest that precautions be taken: [the rule is that] the making of a will by such a testator ought to be witnessed or approved by a medical practitioner who satisfies himself of the capacity and understanding of the testator, and records and preserves his examination and finding.*[17]

In addition to the formal assessment of mental capacity by a medical practitioner, the judge expects that the examination and findings should be recorded. This expectation illustrates the role of practitioners as expert witnesses in a formal forensic assessment. The practitioner's evidence should be able to help a judge make a proper determination of mental capacity in any future dispute.

Conclusions and recommendations

An EPA is a useful legal instrument that can extend the autonomy of a donor to a time when he or she is no longer mentally capable. Although the use of EPAs should be encouraged, the certification of mental capacity should be performed appropriately. In regard to the case vignette, the MMSE score neither proves nor disproves the patient's mental capacity. Some degree of general cognitive impairment does not specifically indicate whether or not a patient is mentally capable to make an EPA. Therefore, in this case, if the patient were able to clearly understand the nature and effect of an EPA, he should be advised to seek legal advice on making an EPA. A solicitor and a registered medical practitioner would be required to certify his mental capacity. Before the mental capacity assessment, the EPA to be executed should be explained to him clearly. Evaluating his decision-making abilities relevant to the EPA (to be executed) may help in establishing the mental capacity. Proper documentation of the assessment is essential. In complicated cases or where mental illness is present, psychiatric consultation should also be considered.

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Scrotal wall metastasis as the first manifestation of primary gastric adenocarcinoma

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A B S T R A C T

Metastases to the scrotal wall are very rare, and being the initial manifestation of occult primary tumours is even rarer. We report on a patient presenting with painless scrotal swelling, attributed to a solid extra-testicular mass found on ultrasonography. Subsequent investigations and surgical exploration revealed it to be a scrotal wall metastasis from an occult gastric primary. To our knowledge, this is the first report of a scrotal wall metastasis from gastric adenocarcinoma. The ensuing discussion and literature review highlight the diagnostic challenges posed by an extra-testicular scrotal metastasis from an occult primary tumour.

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Introduction

Metastases from gastric adenocarcinoma to scrotal structures are rare, most being intra-testicular. Extra-testicular metastases are even rarer. It is extremely rare for such a metastasis to be the first manifestation of an occult primary tumour. Herein we report on a patient who presented with a solid extra-testicular mass, which was later confirmed to be a scrotal wall metastasis from an occult gastric adenocarcinoma. To our best knowledge, there has been no previous report of a scrotal wall metastasis from gastric adenocarcinoma.

Case report

A 66-year-old man, who enjoyed unremarkable past health, presented with a 2-week history of painless

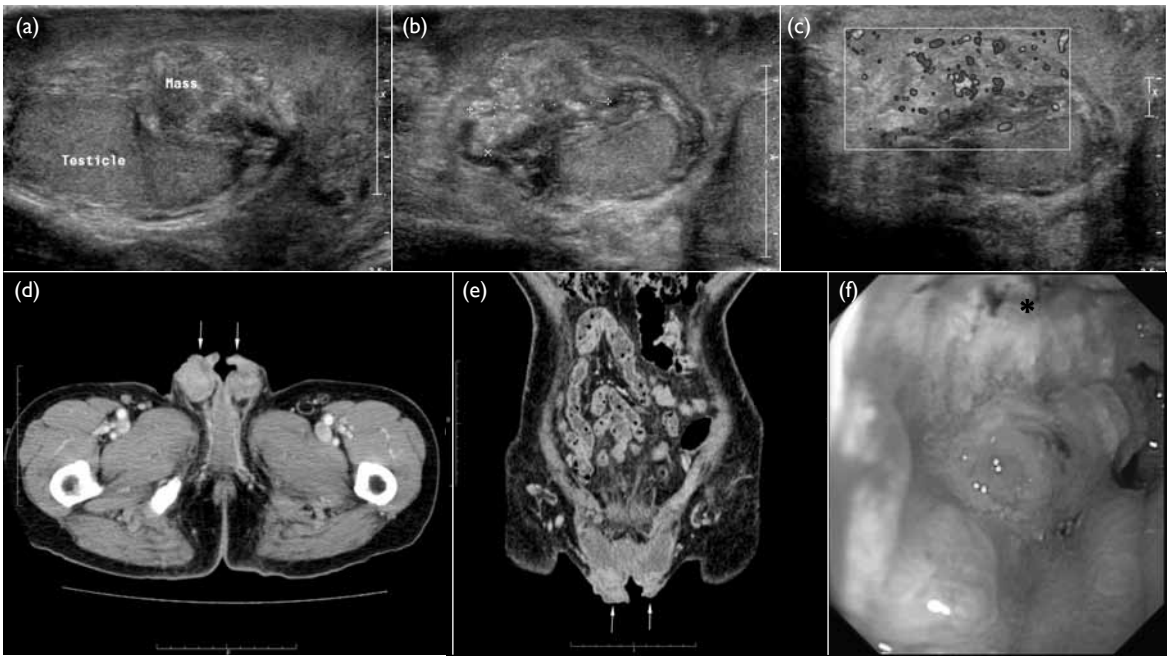

FIG 1. (a) Longitudinal and (b) transverse sonography of the right scrotum showing a solid extra-testicular mass separated from the normal-looking right testis. (c) Increased vascularity was evident on Doppler study. (d) Axial and (e) coronal computed tomographic images of the scrotum revealing bilateral scrotal soft-tissue thickening (arrows). (f) The oesophagogastroduodenoscopy reveals an irregular ulcerative tumour (*) over the lower part of gastric body

'right testicular' swelling in May 2011. Examination yielded a 4-cm hard, irregular, and non-tender right scrotal mass.

An urgent ultrasound revealed an 18 x 13 x 21-mm solid extra-testicular mass with heterogeneous echogenicity in the right scrotum (Figs 1a-c), which was separate from the normal-looking right testis. Equivocal involvement of the right epididymis was noted on the ultrasound at that time. Increased vascularity of the mass lesion was noted on colour Doppler study. A small right hydrocele was also evident.

In view of a possible malignancy, the patient then underwent surgical scrotal exploration, which revealed a markedly thickened scrotal wall. The dartos muscles could not be well delineated and considered a probable sight of invasion by tumour, though the fat plane between the scrotal wall and the tunica was preserved. The testes could be well separated from the thickened scrotal wall.

A full-thickness scrotal wall incisional biopsy revealed diffuse infiltration of the subcutaneous tissue and dartos muscle by aggregates and islands of adenocarcinoma, more heavily on the right side. Evidence of a desmoplastic reaction was noted. The scrotal skin was unremarkable (Figs 2a-b).

Immunological studies showed that the tumour cells were positive for CK7, carcinoembryonic antigen, p53, and CDX2; focally positive for CK20 and negative for prostate-specific antigen (Figs 2c-f). These features favoured a tumour of the upper gastro-intestinal or genital origin. Biopsies of the urethra and urinary bladder from the same operation were negative of malignancy.

Subsequent computed tomography (CT) of the abdomen and pelvis to search for any underlying malignancy showed bilateral scrotal soft tissue thickening (Figs 1d-e), and oesophagogastroduodenoscopy revealed a hard, irregular, and circumferential ulcerative tumour over the lower part of body of stomach (Fig 1f).

陰囊壁病變作為原發性胃腺癌轉移

梁肇庭、朱志揚、賴銘曦、張文鳳、邱麗珊

癌轉移至陰囊壁非常罕有，而作為隱匿性原發腫瘤的初發表現更是罕見。本文報告一名出現無痛性陰囊腫脹的病人，在超聲圖上顯示在睾丸以外有一個灶。隨後的檢測及手術均證實此灶從一個隱匿性胃癌轉移至陰囊壁。據我們所知，這是首宗陰囊壁病變作為原發性胃腺癌轉移的病例報告。本文續討論從隱匿的原發腫瘤轉移至睾丸所帶來的診斷挑戰，並作文獻回顧。

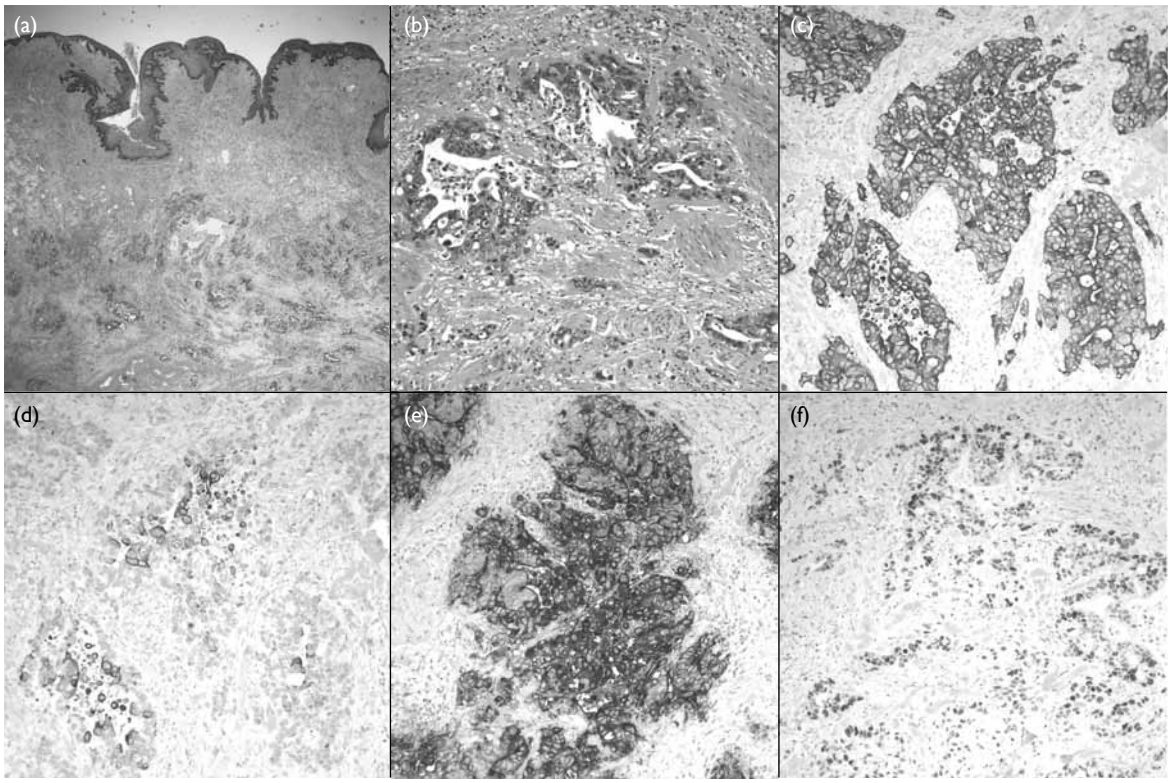

FIG 2. Pathological examination showing that (a) the soft tissue underlying the scrotal skin was infiltrated by adenocarcinoma (H&E, x 20) and (b) malignant glands lined by pleomorphic cells seen in the dartos muscle (H&E, x 200). Immunohistochemical studies (x 200) showing (c) tumour cells positive for CK7, but (d) only focally positive for CK20, and (e) strongly positive for carcinoembryonic antigen and (f) partly positive for p53. The overall features favour a tumour from the upper gastro-intestinal or genital origin

Biopsy of this ulcerative tumour revealed a poorly differentiated adenocarcinoma.

Palliative chemotherapy with the XELOX regimen (capecitabine plus oxaliplatin) was started. The chemotherapy regimen was subsequently changed to the FOLFOX regimen (folinic acid, fluorouracil, and oxaliplatin) because of progression of the gastric malignancy. He remained otherwise asymptomatic 10 months following the initial presentation, when this report was submitted for publication.

Discussion

The scrotum is a musculocutaneous sac composed of two compartments, divided by a midline septum. Each compartment contains a testis, epididymis, spermatic cord, and associated fascial coverings.[1] The scrotal wall is composed of pigmented skin, subcutaneous tissue, and the closely related dartos fascia and dartos muscle.

Metastases to scrotal structures are rare. Among these, the testis is the most frequently involved site. Less than 3% of testicular malignancies are secondaries; the lung, prostate, and gastro-intestinal tract are the most common primary sites.[2,3] Metastases to extra-testicular scrotal structures such as the epididymis, spermatic cord, and scrotal wall are even rarer. Metastases account for 8.1% of malignancies in the epididymis and spermatic cord,[3,4] mostly reported as single case reports.[3]

Metastasis to the scrotal wall involving the subcutaneous tissue and dartos muscle with normal scrotal skin (as in our patient) is extremely rare. A previous review could only identify sporadic cases of scrotal wall metastases; the primaries being from malignant melanoma, anal carcinoma, and lung carcinoma.[5] To our best knowledge, no scrotal wall metastasis from gastric adenocarcinoma has ever been reported in the literature. On the other hand, cutaneous metastases involving the scrotal skin alone are relatively more common. In contrast to scrotal wall metastases which present as a scrotal swelling, scrotal skin metastases present as cutaneous polypoid lesions, ulcers, or papules.[6-8]

Several pathways by which primary tumours metastasise to the scrotal structures have been proposed. They include retrograde venous embolism, retrograde lymphatic extension, arterial embolism, direct invasion along the testicular cord, and transperitoneal seeding through a congenital hydrocele.[9] Although the exact pathway of the metastasis in our patient is not clear, absence of intra-abdominal, pelvic lymphadenopathy, and testicular cord thickening all favour embolism or transperitoneal seeding as the route.

Clinically, a scrotal wall metastasis usually presents as a painless scrotal swelling with normal overlying skin, with a firm-to-hard mass being evident on physical examination. Ultrasonography usually reveals a solid extra-testicular mass, that is mostly hypoechoic but can have variable echogenicity.[2] Previously described sonographic features of a scrotal wall metastasis from a lung primary also entailed increased peripheral vascularity and poor delineation with the epididymis,[2] in which the features were also observed in our patient.

Ultrasonography is usually the first imaging modality for evaluating patients presenting with scrotal swelling. Its high spatial resolution provides nearly 100% sensitivity in identifying a scrotal mass and a 98 to 100% sensitivity in differentiating intra-testicular versus extra-testicular lesions.[1] The two most important factors to consider during evaluation of a scrotal mass are whether it is intra- or extra-testicular in location, and whether it is cystic or solid in nature.[1] This is because more than 95% intra-testicular masses are malignant while most that are extra-testicular are benign.[10]

Most extra-testicular masses are cystic and almost all are benign.[1] Solid extra-testicular masses are uncommon and 97% of them are also benign.[1,11] Among these solid extra-testicular masses, lipoma and adenomatoid tumours are most frequently encountered, and account for about 45% and 33% of all extra-testicular masses, respectively.[11]

Malignancies account for the remaining 3% of extra-testicular masses. It was estimated that 8.1% of malignancies in the epididymis and spermatic cord are due to metastases.[3,4] Rhabdomyosarcoma is the most common primary malignant tumour, accounting for 40% of all malignant extra-testicular tumours and are most common in infants and children.[11] In adults, examples of primary malignant tumours include leiomyosarcoma, liposarcoma, fibrosarcoma, malignant fibrous histiocytoma, and primary adenocarcinoma of epididymis.[5]

Secondary extra-testicular malignant tumours usually occur against a background of known advanced malignancy. Common primary sites include prostate, kidney, gastro-intestinal tract, and pancreas.[11] Epididymis and spermatic cord are the usual sites of involvement, while scrotal wall metastases are extremely rare. Only sporadic case reports can be identified in the literature for metastases to the scrotal wall (from melanoma, anal carcinoma, and lung carcinoma).[2,12]

Lesion diameter, volume, and presence of vascularity on Doppler ultrasonography assist differentiation of malignant from benign lesions.[13] Multifocal lesions and heterogeneity have also been suggested as supporting metastatic disease.[14,15] However, in most instances, considerable overlap in sonographic appearances of many solid extra-testicular masses preclude a specific diagnosis.[1]

Magnetic resonance imaging (MRI) is useful in characterising certain extra-testicular lesions such

as lipoma, haematoma, and fibrous pseudotumour. Enhancement patterns in gadolinium-enhanced MRIs are also useful in differentiating malignant from benign lesions. In such cases, MRI findings may obviate the need for surgery or change the surgical approach.[14]

In patients without a known history of malignancy such as ours, diagnosis of an extra-testicular metastasis on the initial ultrasound is difficult. The sonographic differential diagnosis includes other extra-testicular benign and malignant tumours. Clinical correlation is essential to enable better differentiation of malignant from benign lesions. The clinical finding of a hard scrotal mass in our patient raised concerns of malignancy, and hence surgical exploration was undertaken. The final diagnosis still depends on biopsy and pathological study. In our patient, histology and immunological studies of the scrotal wall biopsy hinted at the final diagnosis of occult gastric adenocarcinoma. Although positron emission tomography–CT may be useful for seeking an occult primary malignancy, it is not commonly used as a first-line imaging modality in patients presenting with a scrotal wall lesion. However, it could be offered to search for an underlying primary when histology shows adenocarcinoma but immunological study results are pending.

Conclusion

Extra-testicular metastases are rare and have non-specific sonographic features, which always pose difficulties in diagnosis, particularly in patients without a known primary malignancy. We hereby report the first case of a gastric adenocarcinoma presenting as scrotal wall metastasis. This case also demonstrates the importance of radiological, clinical, and pathological correlations in making the final diagnosis.

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Ketamine-induced cholangiopathy

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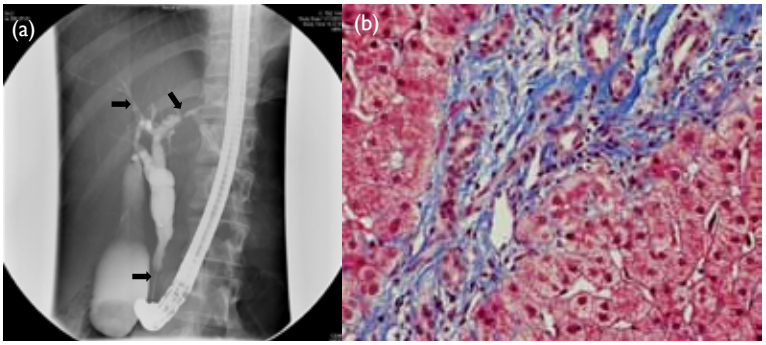
A 28-year-old woman presented to us in November 2010 because of deranged liver function test results; predominantly she had raised levels of ductal enzymes. She had been a chronic ketamine abuser for 5 years and was followed up by psychiatrists. Endoscopic retrograde cholangiopancreatography was performed in November 2011, and yielded a 5-cm stricture at the lower end of common bile duct (CBD) with bilateral small segmental strictures affecting the intrahepatic ducts (a). Brush cytology of the CBD stricture did not reveal any malignant cells. A plastic stent bypassing the CBD was inserted for drainage. Liver biopsy showed mild-to-moderate portal fibrosis with ductular proliferation (b, Masson's trichrome stain, x 200), and periportal copper deposits, which were consistent with chronic cholestasis. Liver function improved after the patient ceased recreational use of ketamine.



The full version of this paper can be found on <www.hkmj.org>.

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What is the diagnosis?

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A 39-year-old Rhesus-positive mother had been well. She had been screened low risk (1:2496) for Down syndrome at the first-trimester combined screening in late 2012. The fetal morphology scan at 20 weeks of gestation was normal, but bilateral pleural effusions were evident at 32 weeks of gestation. Amnioreduction and left pleural tap yielded 35 mL of pleural chyle. There was no evidence of a viral infection. An oedematous girl with a distended abdomen and hepatomegaly was delivered at the 33-week-6-day gestation by caesarean section. Pleural effusions were drained by pleural tapping and chest drains. Echocardiography showed normal cardiac structure and function. Plasma total protein was 35 g/L (reference range, 65-82 g/L) and albumin 22 g/L (35-52 g/L). The highest blood white cell count was 84.2 x 10^9/L (50% blasts). What is the underlying diagnosis for this infant's chylothoraces, hypoproteinaemia, and leukocytosis: (a) immune hydrops, (b) trisomy syndrome, (c) congenital infection, (d) congenital lymphoma, or (e) inborn error of protein metabolism?

The full version of this paper and answer can be found on <www.hkmj.org>.

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Psychiatry with a scalpel — making smiles, changing lives

Interview with Dr Peter Pang

by: Winnie Sung and Clara Tsui
Year 3, Faculty of Medicine
The Chinese University of Hong Kong

What is the difference between finishing a task, and completing it? To finish a task, one uses it as a means to an end; but to complete a task, one must go above and beyond these expectations, and satisfy one's greatest judge: oneself.

To Dr Peter Pang, this distinction is the key to his approach to life. He trains himself to think outside the box and aspires to do more than what is socially expected, and these motivations drive his charity work.

Making smiles around the world

Dr Pang is a plastic surgeon who was awarded the Hong Kong Humanity Award in 2011 for his community services in Operation Smile International and Rotary International District 3450. After graduating from the Chinese University of Hong Kong in 1994, he started practising at the Prince of Wales Hospital and the Union Hospital. In 1999, his mentor inspired him to start a new journey and he volunteered to work in humanitarian aid with Operation Smile International. This commitment took him on missions to various countries including China, the Philippines, Kenya, and Cambodia, where he and his colleagues offered free surgery for patients with cleft lips and cleft palates.

In 2005, he joined the executive board of Operation Smile China Medical Mission. Through collaboration with his colleagues, he set up the first Operation Smile Charity Hospital in Hangzhou and Kunming, which made medical care accessible to children suffering from cleft lip in the region. Currently, Dr Pang works in the Paragon Clinic in Central and continues his humanitarian work as President of the Rotary Club in the New Territories.

Patient needs, limited resources, and tough decisions

An overarching theme of responsibility towards people with limited resources colours Dr Pang's illustrious career. Cleft lip, although not life-threatening, has a serious impact on quality of life. Apart from the detriment to self-image and confidence, having a cleft lip also hinders speech and teeth development in children, which results in lifelong social, financial, and medical problems. In his 10 years of service with Operation Smile, Dr Pang has firsthand experience of the overwhelming need for cleft lip operations, postoperative speech training, and dental correction. He was frustrated that he could only perform about 40 operations per annual trip due to resource and logistical limitations. So, drawing inspiration from his role model Professor Arthur Li, Dr Pang traded the gratification of volunteerism for administrative work to recruit more doctors and exponentially increase the number of children he could help. However, as an administrator, Dr Pang faced new challenges and had to make tough decisions. What was to be the age

limit for children to receive corrective surgery? Who had higher priority? Who should benefit the most from the given resources?

Surgery: psychiatry with a scalpel?

Dr Pang refers to plastic surgeons as "psychiatrists with scalpels". He shares several stories to illustrate his point. On a mission in China, Dr Pang met a family with cleft lips in three consecutive generations. The elderly grandmother, who was wheelchair-bound, made a point to kneel and beg the doctors to operate on her daughter and granddaughter. He also met two brothers, aged 17 and 18 years, who both saw Operation Smile as a chance to change their school and job prospects. However, when the younger brother was offered the operation, he requested that the doctors operate on his brother instead, to help further the brother's career. Dr Pang also recalls encountering a child with a cleft lip that had never been kissed by his parents, because they had been afraid to. Immediately after the operation, the child said he wanted to kiss his parents, and was finally able to show and receive the kind of parent-child affection that most people take for granted. Such examples illustrate how Dr Pang's operations go beyond restoring physical appearances: with the scalpel, by substantially changing the lives of his patients and giving them hope. In turn, Dr Pang witnessed humanity and selfless love, and in giving hope for the future, he felt he was bringing his work to completion.

Operation Smile and the future

Operation Smile continues to thrive for the betterment of children worldwide. As of writing, 27 more missions are planned in 2014, and will encompass countries in Southeast Asia to South America. For more information on the organisation's work and for ways to contribute, please visit www.operationsmile.org.

(*Facing page*)
The psychiatrist with a scalpel, changing this child's life forever

(*Bottom*)
Operation Smile brings professionals together from different parts of the world

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