

Total knee arthroplasty is safe for patients aged ≥ 80 years in Hong Kong

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ABSTRACT

Introduction: Total knee arthroplasty (TKA) is an efficacious operation that improves pain and function in patients with knee arthritis. Because of the population ageing trend in Hong Kong, there is a need to determine the safety profile of TKA in older patients. This study examined the age of patients who underwent TKA in the past 10 years in Hong Kong; the aim was to investigate the mortality safety profile and clinical outcomes of TKA in patients aged ≥ 80 years.

Methods: This study included all patients who underwent primary TKA in the Hospital Authority (HA) from 2010 to 2019. Incidences of 30-day, 90-day, and 1-year mortality were established. Clinical outcomes of patients aged ≥ 80 years in one cluster of HA hospitals were assessed.

Results: Between 2010 and 2019, 25 040 TKA procedures were conducted in all HA hospitals; 2491 were conducted in patients aged ≥ 80 years. The median age at operation was higher during 2015-2019 than during 2010-2014 (70 vs 69 years; $P < 0.001$); furthermore, an increase was observed in the proportion of patients aged ≥ 80 years at the

time of operation. Incidences of 30-day, 90-day, and 1-year mortality were 0.156%, 0.35%, and 1.09%, respectively.

Conclusions: In this first study to examine the safety profile of TKA in older patients in Hong Kong, the mean age at the time of TKA and proportion of patients aged ≥ 80 years have steadily risen in the past decade. Even in older patients, TKA is a reasonably safe procedure.

Hong Kong Med J 2021;27:350-4

<https://doi.org/10.12809/hkmj208942>

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New knowledge added by this study

- The total knee arthroplasty (TKA) caseload, mean age of patients, and proportion of patients aged ≥ 80 years at the time of TKA in Hong Kong has risen steadily in the past 10 years.
- The overall mortality rate within 1 year after surgery among patients aged ≥ 80 years at the time of TKA was 1.09%, which is substantially lower than overall mortality rate of the older general population in Hong Kong.
- TKA is a reasonably safe and efficacious procedure, even in patients aged ≥ 80 years at the time of operation.

Implications for clinical practice or policy

- Adequate resources should be allocated towards TKA in the near future to meet the increasing needs of the ageing population.
- When adequate perioperative assessment and management are instituted, older patients should not be advised to avoid TKA for the management of end-stage knee arthritis.

Introduction

It has been projected that, by year 2036, one in three people in Hong Kong will be aged ≥ 65 years.¹ Because the life expectancy of the Hong Kong population consistently ranks among the highest worldwide, the medical and social needs of older individuals are expected to increase rapidly in the next few decades. The waiting time for joint arthroplasty in Hong Kong's Hospital Authority (HA) system increased from 33 months in 2010² to 50 months in 2019³, reflecting increasing demand for such procedures in our population.

Total knee arthroplasty (TKA) is a highly successful operation that provides substantial pain relief and functional improvement for patients with end-stage knee arthritis.⁴ However, in Hong Kong, there is the prevalent belief among many members of the community that older patients, particularly those aged ≥ 80 years, have a substantial risk of mortality after TKA. Therefore, despite substantial pain and debilitation, older patients have often avoided TKA as treatment for their knee arthritis. However, this avoidance may no longer be a reasonable approach in the era of modern arthroplasty.

This study examined the age of patients who underwent TKA in the past 10 years in Hong Kong. The aim of the study was to determine the mortality safety profile and clinical outcomes after TKA in patients aged ≥ 80 years at the time of operation.

Methods

All patients who underwent primary TKA between 2010 and 2019 in public hospitals operated by the HA were included in the study. Patient data were extracted from the HA Clinical Data Analyses and Reporting System. Baseline demographic characteristics (eg, age, sex, and diagnosis at the time of operation) were recorded. Patients were stratified according to age (< 80 or ≥ 80 years) at the time of the operation. Incidences of 30-day, 90-day, and 1-year mortality after TKA, as well as the incidence of emergency readmission within 28 days after TKA, were calculated.

Furthermore, all patients who had undergone TKA between 2010 and 2019 in the HA's Hong Kong West Cluster of hospitals, who were aged ≥ 80 years at the time of operation, were identified for inclusion in the study. The Hong Kong West Cluster comprises seven hospitals, providing a total of 3142 beds.³

Baseline preoperative parameters, including the Charlson Comorbidity Index (CCI),⁵ as well as the Knee Society Knee Score (KSKS) and Knee Society Knee Functional Assessment (KSFA) scores,^{6,7} were recorded. Rehabilitation outcomes, including KSKS and KSFA scores, were recorded at 1 year after surgery and at the latest follow-up.

For data collection and statistical analyses, SPSS (Windows version 26) was used. Age, CCI score, KSKS, and KSFA score were all non-normally distributed, according to the Kolmogorov–Smirnov test. Therefore, the Mann-Whitney *U* test was used to compare the median ages of patients during 2010–2014 and 2015–2019; to compare the median CCI score between older patients who died within 1 year of the operation and patients who survived; and to compare KSKS and KSFA scores before surgery and at 1 year after surgery.

Results

Demographics of patients undergoing total knee arthroplasty in Hong Kong between 2010 and 2019

Between 2010 and 2019, 25 040 TKA procedures were conducted in all HA hospitals. During the same period, 3835 TKA procedures were conducted in the authors' hospital cluster. An increasing trend was observed in the number of TKA procedures each year; the yearly caseload in 2019 was more than double the yearly caseload in 2010 (Table, Fig).

For all HA hospitals, the mean age (\pm standard deviation) at the time of operation throughout the

香港80歲或以上患者進行全膝關節置換術是安全的

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引言：全膝關節置換術（TKR）能有效改善膝關節炎患者的疼痛和功能。隨着香港人口老化，有必要確定TKR在老年患者中的安全性。本研究旨在檢視過去10年香港不同年齡組別的患者進行TKR的趨勢，並確定80歲或以上患者進行TKR的安全性，包括死亡率以及臨床結果。

方法：包括2010年至2019年期間在醫院管理局（醫管局）接受初次TKR的所有患者，檢視TKR後30天、90天和1年死亡率，並評估醫管局其中一個聯網中80歲或以上患者的臨床結果。

結果：2010年至2019年期間，所有醫管局醫院進行25 040例TKR，其中80歲或以上患者佔2491例。與2010年至2014年的數據相比，2015年至2019年期間接受TKA的患者年齡中位數較高（70歲比69歲； $P < 0.001$ ）。在這10年期間，80歲或以上患者接受TKA的比例亦有上升趨勢。術後30天、90天和一年內死亡率分別為0.156%、0.35%和1.09%。

結論：這是香港首個有關老年人進行TKR的安全性研究。在過去十年，80歲或以上患者進行TKR的平均年齡有上升趨勢。研究表明TKR即使對老年患者也是一種相當安全的手術。

study period was 69.4 ± 7.7 years (range, 18–94). Median age at the time of operation significantly increased from 69 years (interquartile range [IQR], 58–80) in 2010–2014 to 70 years (IQR, 59–81) in 2015–2019 ($P < 0.001$).

An increase in the proportion of patients aged ≥ 80 years at the time of operation was observed throughout the study period (Table, Fig).

Safety of total knee arthroplasty in patients aged ≥ 80 years

Between 2010 and 2019, 2491 TKA procedures were conducted in all HA hospitals in patients aged ≥ 80 years. The median age at operation was 82 years (IQR, 80–84). Mortality rates within 30 and 90 days after surgery were 0.156% and 0.35%, respectively. The mortality rate within 1 year after surgery was 1.09%. In total, 5.3% of patients required emergency readmission within 28 days of TKA.

During the study period, 22 549 TKA procedures were conducted in all HA hospitals in patients aged < 80 years. The mean age (\pm standard deviation) at operation was 67.9 ± 6.8 years (range, 14–79). Mortality rates at 30 days, 90 days, and 1 year after surgery were 0.047%, 0.128%, and 0.441%, respectively. In total, 4.02% of patients required emergency readmission within 28 days after surgery.

Between 2010 and 2019, 574 TKA procedures were conducted in patients aged ≥ 80 years at the time of operation in the authors' HA hospital cluster. The mean age (\pm standard deviation) at operation was 82.9 ± 2.6 years (range, 80–93).

TABLE. Total TKA procedures and relevant patient age data for 2010 to 2019 in the Hospital Authority of Hong Kong and in the Hong Kong West Cluster*

Year	Hospital Authority†			Hong Kong West Cluster†		
	Total TKA	Patient age, y, mean (95% CI)	Patients aged ≥80 years	Total TKA	Patient age, y, mean (95% CI)	Patients aged ≥80 years
2010	1444	69.05 (68.65-69.46)	123 (8.5%)	191	69.24 (67.96-70.51)	21 (11.0%)
2011	1800	68.67 (68.7-69.39)	144 (8.0%)	212	70 (68.77-71.23)	32 (15.1%)
2012	2079	69.05 (68.7-69.39)	210 (10.1%)	262	70.24 (69.21-71.27)	43 (16.4%)
2013	2219	68.91 (68.57-69.25)	233 (10.5%)	289	71.31 (70.27-72.35)	66 (22.8%)
2014	2350	68.93 (68.61-69.24)	216 (9.2%)	336	70.59 (69.74-71.43)	54 (16.1%)
2015	2593	69.49 (69.2-69.79)	248 (9.6%)	323	71.49 (70.56-72.41)	69 (21.4%)
2016	3021	69.3 (69.03-69.57)	276 (9.1%)	509	70.86 (70.18-71.54)	88 (17.3%)
2017	2931	69.85 (69.58-70.13)	331 (11.3%)	587	70.09 (69.48-70.71)	68 (11.6%)
2018	3126	69.75 (69.49-70.00)	323 (10.3%)	557	69.96 (69.29-70.62)	68 (12.2%)
2019	3477	69.94 (69.7-70.19)	387 (11.1%)	569	69.33 (68.69-69.98)	65 (11.4%)

Abbreviation: TKA = total knee arthroplasty

* Hong Kong West Cluster is a group of seven hospitals and institutions administered as a single unit operated by the Hospital Authority of Hong Kong

† Data are presented as No. or No. (%), unless otherwise noted

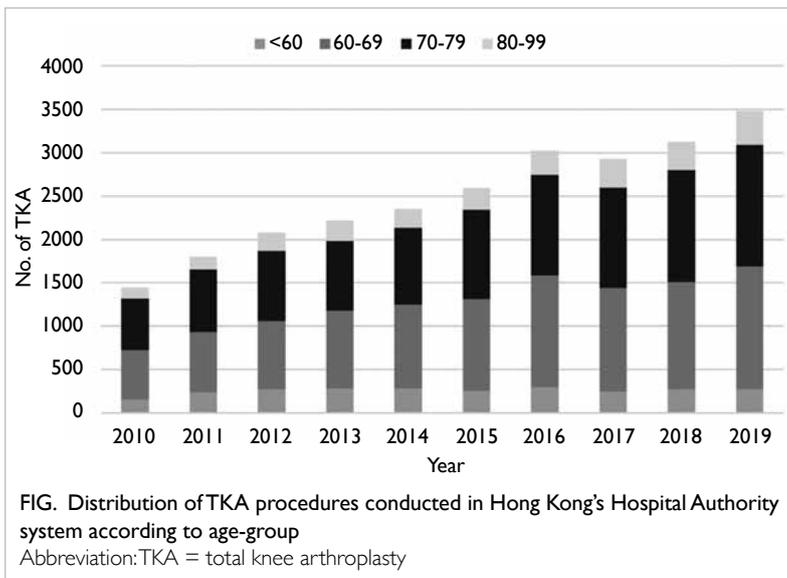


FIG. Distribution of TKA procedures conducted in Hong Kong's Hospital Authority system according to age-group

Abbreviation: TKA = total knee arthroplasty

The mean CCI score (\pm standard deviation) at the time of operation was 4 ± 1.1 (range, 4-11). The CCI score was not significantly different between older patients who died within 1 year after surgery and older patients who survived beyond this time period (median: 5 vs 4; $P=0.565$).

Clinical outcomes in older patients after total knee arthroplasty

The median KSKS improved from 45 before surgery to 94 at 1 year after surgery ($P<0.001$). The median

KSFA scores improved from 45 before surgery to 55 at 1 year after surgery ($P<0.001$).

Discussion

In the past decade in Hong Kong, the proportion of patients aged ≥ 80 years at the time of operation increased from 8.5% in 2010 to 11.1% in 2019. Moreover, the proportions of patients aged ≥ 80 years at the time of operation were 9.3% and 10.3% during 2010-2014 and 2015-2019, respectively. These proportions are higher than the values reported by Yan et al,⁸ who examined the demographics of TKA usage in the preceding decade (ie, 2000-2009) in Hong Kong.

In 2019 in Hong Kong, the mean age at the time of operation was 69.9 years; this was similar to the mean ages from studies in the United Kingdom (69 years)⁹ and Australia (68.5 years)¹⁰. Furthermore, the mean age at the time of the operation increased throughout the study period among all patients undergoing TKA in the HA system. This pattern has also been observed in Taiwan,¹¹ but it contrasts with the findings in the United States and Canada, where overall decreases in mean age have been observed.¹²

Overall, the mortality rates among older patients in the present study were similar to those reported in other countries.^{13,14} However, the mortality rates among older patients undergoing TKA in the present study are higher than the mortality rates reported among patients of all ages undergoing TKA in the HA¹⁵ (0.1%, 0.2% and 0.7% at 30 days, 90 days and 1 year, respectively) and in other localities (0.18% within 30 days after surgery).¹⁶

Although the mean age of the overall patient cohort was not reported in the study by Lee et al,¹⁵ the mean ages of the mortality and non-mortality groups were 78 and 64 years, respectively. These are both substantially lower than the mean age at operation for the older patient group in the present study (82.8 years). Although mortality rates at 30 days, 90 days, 1 year and 5 years after surgery differed between the present study and the study by Lee et al,¹⁵ the values were generally comparable.

The differences in mortality risk between older and younger patients in the present study are consistent with the findings in a meta-analysis by Kuperman et al,¹⁷ who reported increased mortality in older patients after TKA. This is likely related to underlying differences in the inherent mortality risks between older and younger patients caused by age-related increases in the number of medical co-morbidities. In Hong Kong in 2018, the age-specific mortality rates for the general population aged 80 to 84 years were 5.5% and 3.2% for men and women, respectively.¹⁸ In the present study, the overall mortality rate within 1 year after surgery for the older patient cohort was 1.09%, substantially lower than the overall mortality rate of the older general population in Hong Kong. This likely reflects the stringent preoperative screening protocol used for older TKA candidates, which is intended to minimise the risk of mortality.^{13,15} Therefore, with careful perioperative assessment and management, mortality risk after TKA can be minimised, even in older patients.

Finally, the present study revealed that both KSKS and KSFA scores were significantly improved at 1 year after TKA, compared with scores before surgery. Therefore, pain, objective physical examination findings, and function in terms of walking and ability to climb stairs can be significantly improved after TKA, even in older patients. Our results support the findings in previous literature.^{19,20}

An important limitation of the retrospective study design was that it did not allow us to control for confounding variables, such as differences in surgical expertise and standards of perioperative care among the centres included in this study. However, to our knowledge, this is the only study regarding the incidence of mortality after TKA among older patients in Hong Kong. The results of this study are important for our locality because they describe TKA outcomes from all HA hospitals in the past 10 years in a large cohort of patients.

In conclusion, this study showed that the mean age at the time of TKA has steadily risen in the past 10 years, consistent with population ageing trends in Hong Kong. Furthermore, the findings indicate that TKA is a safe and efficacious procedure, even in older patients. Therefore, provided that proper perioperative assessment and management are

conducted, advanced age should not be a deterrent for TKA in the management of end-stage knee arthritis among older patients who can substantially benefit from this procedure.

Author contributions

Concept or design: A Cheung, CH Yan, KY Chiu.

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Critical revision of the manuscript for important intellectual content: A Cheung, CH Yan, KY Chiu.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have disclosed no conflicts of interest.

Funding/support

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethics approval

This research has received approval from the Institutional Review Board of The University of Hong Kong/Hospital Authority Hong Kong West Cluster (Ref UW 20-161).

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