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The comparative impact of video-consultation on emergency neurosurgical referrals

Key Messages

1. Emergency neurosurgical consultation assisted by teleradiology and video-consultation achieves a higher diagnostic accuracy compared to conventional telephone consultation.
2. Compared to teleradiology-assisted emergency neurosurgery, video-consultation offers no advantage in terms of process-of-care indicators, clinical outcome, and costs.
3. Although the time taken for video-consultation is significantly longer, it has proven to be a safe mode of consultation in the course of emergency neurosurgery.

Introduction

Current neurosurgical resources are concentrated in tertiary referral centres. Neurosurgical emergencies identified by physicians from district general hospitals are traditionally referred by telephone consultation. In a case control study, we demonstrated that the deployment of teleradiology of computed tomographic brain scans significantly reduces the incidence of unnecessary transfer and consequential adverse effects.¹ Subsequently, real-time audio-visual teleconsultation has been shown to be feasible and affordable in neurology out-patient clinics.² Regarding neurosurgical emergencies in district general hospitals, we wished to explore whether there was a need to enhance teleradiology with video-conferencing facilities, and if so, whether it is cost-effective.³

Methods

Study design

This study was conducted from October 1998 to September 2001 at a large district general hospital with 1400 beds (United Christian Hospital) and the tertiary neurosurgical centre in a teaching hospital with 1400 beds and a catchment population of 1.5 million (Prince of Wales Hospital). The hospitals were 'separated' by a 30-minute ambulance journey. Identical low-cost commercial interactive video-conferencing equipment (Polycom view station, Polycom Inc, San Jose [CA], US) was installed in the accident and emergency departments of the two hospitals, connected by one ISDN line transmitting information at 128 kilobits per second. Consecutive patients requiring emergency neurosurgical consultation from the district general hospital were recruited and stratified into three groups: (A) head injury, (B) haemorrhagic stroke and subarachnoid haemorrhage, and (C) miscellaneous conditions with symptoms and signs of increased intracranial pressure or focal neurological deficits (eg hydrocephalus, brain tumour, brain abscess, and chronic subdural haematoma). The patients were randomised by double-sealed envelopes to the three modes of consultation—(I) for telephone consultations, the referring physician was required to discuss the case history, physical signs, and relevant investigations in detail over the telephone with the on-call neurosurgical specialist; (II) for teleradiology consultations, in addition to the aforementioned telephone communication, computed tomographic brain scan images were transferred from the district general hospital to the neurosurgical centre via a telephone line and a personal computer (Multiview Teleradiology for Windows version 2.0); (III) for video-consultations, real-time audio-visual video-conferencing was carried out between the referring physician and the on-call neurosurgeon; both the referring physician and the on-call neurosurgeon could visualise the patient and relevant radiological images.

Sample size

The sample size estimation was based on published data⁴ and our previous data, assuming a significance level of 0.05 and a power of 0.8. We expected 183 patients for each consultation mode would be required to demonstrate a 30% improvement in favourable outcome from 50% to 65%, which is both statistically and clinically significant (important) for health care delivery.

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Table. Summary of patient characteristics, process-of-care indicators, and outcomes

Variables	Telephone consultation (I)	Teleradiology consultation (II)	Video-consultation (III)	P value (II vs I)	P value (III vs I)
No. of patients	235	239	236	0.864	0.944
Head injury	74	77	73	-	-
Stroke	106	111	110	-	-
Others	55	51	53	-	-
Male (%)	62.1	57.3	61.9	0.286	0.953
Mean age (SD) [years]	57.6 (22.4)	57.8 (23.2)	58.8 (20.1)	0.917	0.548
Median admission Glasgow Coma Scale	14.0	15.0	13.5	<0.001	0.244
Mean consultation time (SD) [hours]	0.70 (1.9)	1.01 (1.8)	1.30 (2.5)	0.069	0.004
Failure rate (%)	0	3.8	30.1	-	-
Diagnostic accuracy (%)	63.8	89.1	87.7	<0.001	<0.001
Transfer rate (%)	35.7	28.8	35.6	0.109	0.973
Unfit for transfer (%)	9.8	10.0	11.9	0.926	0.468
Transfer adverse event (%)	3.6	0.0	2.4	-	1.000
Unnecessary transfer (%)	10.8	15.9	8.3	0.340	0.599
Favourable outcome (%)	54.0	61.1	53.8	0.121	0.960
Mortality (%)	34.0	24.7	32.6	0.025	0.745
Mean cost per patient (SD) [HK\$]	92 600 (113 400)	95 100 (150 700)	107 700 (148 600)	0.413	0.090

* Chi squared test is used for non-parametric data and Student's *t* test for parametric data

Outcome measures

Process-of-care indicators (the time taken for the consultation process, appropriateness and adverse events during management, necessity for transfer and diagnostic accuracy), clinical outcome (Glasgow Outcome Scale) and cost-effectiveness analysis for the three modes of emergency neurosurgical consultation were compared.

Results

Seven hundred and ten patients were recruited in a 3-year period between October 1998 and September 2001. Demographic and clinical data of the three modes of consultation were comparable (Table). Apart from diagnostic accuracy, there were no significant differences in the process-of-care indicators, 6-month clinical outcome, and monetary costs per managed patient (Table).

Discussion

The employment of teleradiology and video-conferencing in the management of neurosurgical emergencies in our district general hospital achieved an unequivocally superior diagnostic accuracy than did telephone consultation (88-89% versus 64%, $P < 0.001$). However, this was not translated into benefits in terms of process-of-care indicators and clinical outcomes. Conceivably, the importance of teleradiology over conventional telephone consultation overwhelmed the favourable impact of video-consultation over teleradiology. However this study did not adequately

explain for the lack of clinical benefits of teleradiology over conventional telephone consultation. The efficacies of (or time taken to carry out) video-consultation, teleradiology, and telephone consultation were significantly different (1.3 versus 1.0 versus 0.7 hours, $P = 0.009$), resulting in a high failure rate for video-consultation; 30.1% versus 3.8% versus 0%, respectively. With caution in the management of patients who are 'unfit for transfer', video-consultation has been shown to be safe.

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