ANZJSurg.com

Teleconference fracture clinics: a trial for rural hospitals

Most experience in telemedicine in orthopaedics has been in teleradiology, where a specialist provides advice based only on the radiograph of a patient's injury.[1–4] There have been few trials of full teleconsultations, involving history, examination and imaging analysis of the patient by a specialist in another centre communicating with a doctor and patient in a remote location, via video link in real time. However, such studies have shown that teleconsultations reduced unnecessary patient transfers by 69 to 75%, and are a reliable alternative to live consultations.[5–8]

For 5 months in 2011, 12 trial teleconsultation fracture clinics were conducted between the large city centre, the Princess Alexandra Hospital (PAH), and the rurally located Mt Isa Hospital (MIH). Fracture clinics at MIH are ordinarily conducted twice weekly by an unaccredited orthopaedic registrar. To obtain a specialist opinion or further management, the patient needs to be transferred to the nearest referral centre (Townsville Hospital, located 883 km away). The trial teleconsultation fracture clinic replaced the usual Friday fracture clinic at MIH. The satellite link between the clinics allowed the orthopaedic surgeon to conduct a teleconsultation with the registrar and patient (Fig. 1).

The total cost of holding each teleconsultation fracture clinic was $1285. This comprised of $1060 in staff wages for a total of 17 extra work hours each week, and $225 for the production of patient charts at the PAH for clinical records.

The cost of transferring a patient from MIH for assessment at Townsville Hospital totals approximately $1269 per adult patient and $2134 per child patient, as a child patient requires an accompanying adult. This includes $550 for the airfare (paid by the health system), accommodation, transport and food, and an average loss of $404 income for 2 days per adult.[9–12]

Five patient transfers were saved in 6 months, comprising three adults and one child with one accompanying adult. This is a total cost saved of $5941, and an average saving of $495 per clinic. Overall, there was a cost-deficit of $790 per clinic, and for every 24 patients treated in the teleconsultation clinics, one patient transfer to Townsville was saved.

The alternative arrangement for obtaining specialist review is for a specialist to travel to MIH for a fracture clinic. Overall, the cost of sending a specialist to MIH would be $3064 per clinic, comprising $1150 in airfares, accommodation and transport; $552 wages for the duration of the clinic; and $1392 in lost income for the duration of travel.[9,10,13] This is $1779 more than the amount spent on each teleconsultation fracture clinic, and $2569 more than the amount spent on average in patient transfers.

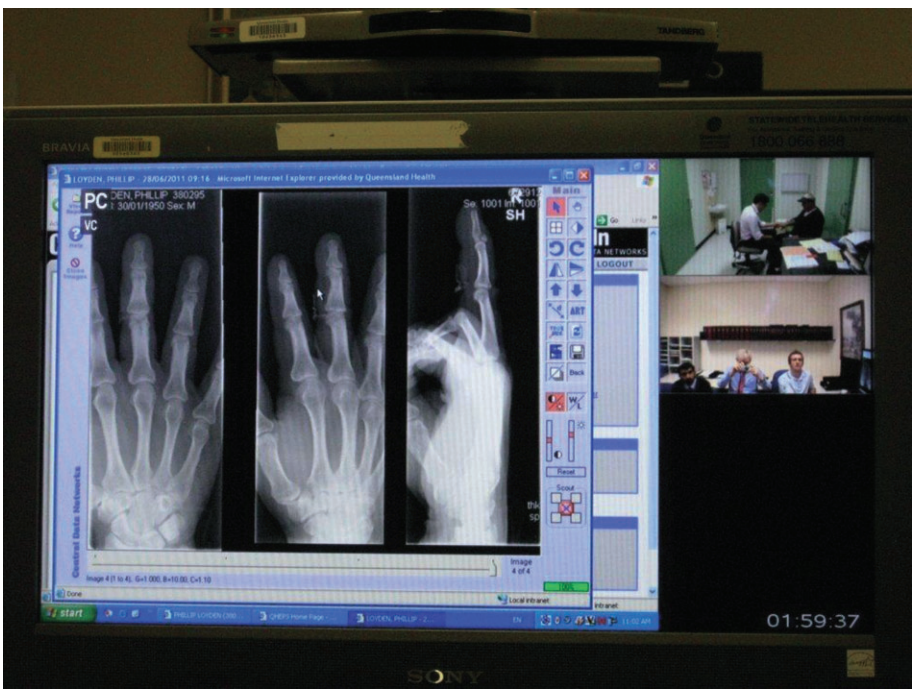


Fig. 1. Real-time interaction between the patient and registrar at Mt Isa Hospital (top right) and the surgeon at Princess Alexandra Hospital (bottom right), with radiographic support.

Even though there is a cost deficit shown in this trial, there is an obvious benefit to the patients' social and financial situations due to the significantly easier access to specialist opinion. The other benefits of the teleconsultation fracture clinic include support for the orthopaedic registrar and a unique opportunity for education in a rural clinical setting.

The main difficulty in running the teleconsultation fracture clinic was the organization of transfer of radiographic imaging onto the PAH radiology system. At least 1 day was required to allow transfer of images, meaning patients could not be seen on the same day, and repeat imaging could not be performed during the clinic.

Some improvements could make the teleconsultation fracture clinic more efficient and less expensive. First, the creation of an electronic appointment book would allow easier management of appointments, and could contain clinical notes, avoiding the expensive duplication of charts at the PAH. Second, the synchronization of imaging systems across all health services to a central radiology service would reduce the time taken to transfer radiographs between hospitals, and allow radiographers to confirm that relevant and recent radiographs exist on the imaging system in advance.

To make the clinic cost-effective, each clinic needs to prevent one patient transfer. An average of 15 patients was booked into the clinic each week, with an average attendance rate of 69% (10 patients). To be cost-effective, either 35 patients would need to be booked into each clinic, or attendance rates would need to be significantly improved. Attendance could be improved by informing patients in advance that the teleconsultation involves contact with a specialist without having to travel to the distant referral centre. In the trial clinics, patients were not told in advance that they would be involved in the teleconference fracture clinic.

Teleconsultation fracture clinics result in fewer patient transfers to referral centres, due to the real time availability of specialist opinion. While teleconsultation fracture clinics have increased running costs, they are still more cost-effective than transferring a specialist to the rural centre to conduct a clinic. The limitations of this study were the small number of clinics held in 6 months and the high failure-to-attend rate. This trial of teleconsultation fracture clinics shows that telemedicine could be effective in reducing costs to the health system, improve patient care and provide additional support for rurally located medical practitioners.

Acknowledgement

The authors would like to acknowledge the contribution of Dr Annabelle Stabler.

References

1. Elkaim M, Rogier A, Langlois J, Thevenin-Lemoine C, Abelin-Genevois K, Vialle R. Teleconsultation using multimedia messaging service for management plan in pediatric orthopaedics: a pilot study. *J. Pediatr. Orthop.* 2010; **30**: 296–300.
2. Chandhanayingyong C, Tangtrakulwanich B, Kiriratnikom T. Teleconsultation for emergency orthopaedic patients using the multimedia messaging service via mobile phones. *J. Telemed. Telecare* 2007; **13**: 193–6.
3. Wallace P, Barber J, Clayton W *et al*. Virtual outreach: a randomised controlled trial and economic evaluation of joint teleconferenced medical consultations. *Health Technol. Assess.* 2004; **8**: 1–106, iii–iv.
4. Tangtrakulwanich B, Kwunpiroj W, Chongsuvivatwong V, Geater AF, Kiatsiriroj N. Teleconsultation with digital camera images is useful for fracture care. *Clin. Orthop. Relat. Res.* 2006; **449**: 308–12.
5. Blank E, Lappan C, Belmont PJ Jr *et al*. Early analysis of the United States Army's telemedicine orthopaedic consultation program. *J. Surg. Orthop. Adv.* 2011; **20**: 50–5.
6. Aarnio P, Lamminen H, Lepistö J, Alho A. A prospective study of teleconferencing for orthopaedic consultations. *J. Telemed. Telecare* 1999; **5**: 62–6.
7. Abboud JA, Bozentka DJ, Beredjiklian PK. Telemedicine consultation for patients with upper extremity disorders is reliable. *Clin. Orthop. Relat. Res.* 2005; **435**: 250–7.
8. Vladzymyrskyy AV. Four years' experience of teleconsultations in daily clinical practice. *J. Telemed. Telecare* 2005; **11**: 294–7.
9. Qantas.com [Internet]. *Australia*. [Cited 2011 June 11.] Available from URL: http://www.qantas.com.au/travel/airlines/home/au/en
10. Wotif.com. *Hotels, Accommodation, Motels, Services Apartments, B&B – Online hotel bookings [Internet]*. [place unknown: publisher unknown]; [Updated 2011; Cited 2011 June 11]. Available from URL: http://www.wotif.com/
11. Townsville Taxi [Internet]. *Townsville, Australia*. [Cited 2011 June 11.] Available from URL: http://www.tsvtaxi.com.au/
12. Australian Bureau of Statistics. *Average Weekly Earnings, Australia*, Feb 2011 [Internet]. Australia. [Last updated 2011 May 19; Cited 2011 June 11.] Available from URL: http://www.abs.gov.au/websitedbs/D3310114.nsf/home/home?opendocument#from-banner=GT
13. Yellow cabs [Internet]. *Australia*. [Cited 2011 June 11.] Available from URL: http://www.yellowcab.com.au/

Alison F. McGill, BSc, MBBS
John B. North,*†‡§¶ FRACS, FAOrthA
**Senior Visiting Orthopaedic Surgeon, Princess Alexandra Hospital, †Senior Visiting Orthopaedic Surgeon, Caloundra Hospital, ‡Clinical Director, Queensland Audit of Surgical Mortality, §Clinical Director, Northern Territory Audit of Surgical Mortality and ¶Past President, Australian Orthopaedic Association, Sydney, New South Wales, Australia*

doi: 10.1111/j.1445-2197.2011.05952.x

Improving care for patients with melanoma

In the last few years there has been a flurry of articles describing significant progress in the understanding and management of melanoma including two highly relevant and practical publications of major interest to clinicians who care for patients with this condition.

The first publication is the new '2009 AJCC Cutaneous Melanoma Staging and Classification System' which was formally adopted in 2010.[1] This new staging system, the seventh edition, is based on nearly 40 000 patients collected from 17 major

melanoma institutions around the world including the Sydney Melanoma Unit which contributed a significant proportion. The current analysis confirms and further refines the major revisions to the standard TNM system first described in the previous sixth edition. T stage is subdivided by tumour thickness (Table 1) and further subclassified by the presence of histologically defined ulceration. This indicates a major deterioration in outcome equivalent to the next higher T stage. An ulcerated T2 lesion (T2b) therefore has a similar outcome to a non-ulcerated T3 melanoma (T3a). In the case of T1 lesions, which account for the majority of melanomas, the familiar Clarke level of invasion has been replaced by the mitotic rate. T1 tumours with ulceration and/or at least one mitosis per square millimetre are designated as higher-risk T1b lesions (Table 1).

Table 1 TNM staging for melanoma (adapted from Balch *et al.*, 2009[1])

T Stage	Tumor Thickness (mm)	
T1	< = 1.00	T1 primary lesions with ulceration or mitotic rate > = 1/mm2 are designated T1b
T2	1.01–2.00	
T3	2.01–4.00	Ulcerated T2-4 primary tumors are designated T2-4 b
T4	>4.00	Mitotic count does not alter the staging in T2-4 melanomas
N Stage	No of Nodes involved	
N0	0	Lymph node metastases are further sub classified as
N1	1	N1-2 a- microscopic metastases
N2	2–3	N1-2 b- macroscopic metastases
N3	4+	N2 c- satellite/in transit lesions without metastatic nodes
		N3- 4+ nodes or matted nodes or in transit metastases/satellites with metastatic nodes
M Stage	Site of Metastasis	
M0	No distant metastases	
M1a	Distant skin, subcutaneous or nodal metastases (Lactate Dehydrogenase {LDH} level normal)	
M1b	Lung metastases (LDH normal)	
M1c	All other visceral or distant metastases &/or elevated LDH	

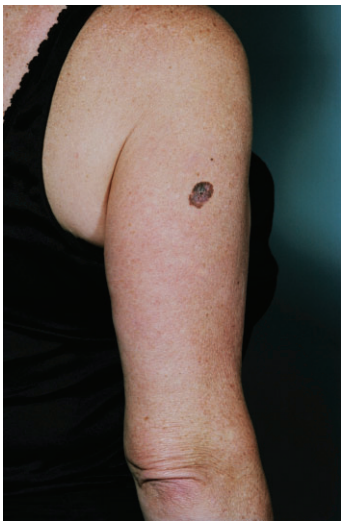
The revised N category recognizes the heterogeneity of patients with regional lymph node metastases and that most node metastases are identified by sentinel node biopsy. The number of involved nodes and tumour burden determines the N stage. Tumour burden is categorized as microscopic disease detected by sentinel node biopsy or macroscopic clinically obvious disease (Table 1). The presence of any size tumour deposit, even isolated tumour cells detected by immunohistochemistry alone, indicates a poorer outcome (Table 2). As in the previous edition of the staging system, the presence of primary tumour ulceration even among patients with lymph node metastases remains prognostically significant (Table 2). Review of the large database also showed that patients with satellite or in transit lesions had similar outcomes to patients with lymph node involvement and are included in the N classification. Finally, among patients with metastatic disease, the site of metastasis (non-visceral versus lung versus other sites) and a raised lactate dehydrogenase determine survival and remain unchanged in the M classification (Table 2).

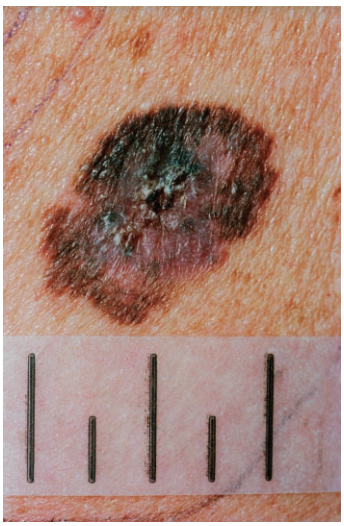
The importance of this new staging system cannot be overemphasized as it provides a basis for evidence-based management at all the stages of the patient's journey with melanoma. In major melanoma treatment centres, TNM staging drives patient care, imaging, provides prognostic information and permits comparison of results. Survival by stage is described in the paper and in addition an Internet-based prognosis tool based on the AJCC data set which provides individualized survival information at 1, 2, 5 and 10 years with 95% confidence intervals is accessible at http://www.melanomaprognosis.org.

The other publication, a totally antipodean affair, is the new 'Clinical Practice Guidelines for Management of Melanoma in Australia and New Zealand' published by the Cancer Council of Australia, the Australian Cancer Network (Sydney) and the New Zealand Guidelines Group (Wellington) in 2008.[2] These guidelines which have been endorsed by the Australian National Health and Medical Research Council and the New Zealand Guidelines Group

Table 2 Stage-grouping and estimated five year survival rates for patients with melanoma (adapted from Balch *et al.*, 2009[1])

Stage	TNM classification	Descriptive listing	Survival 5 yr (estimated)
Stage IA	T1a N0M0	Thin melanoma	97%
Stage IB	T1bN0M0/T2aN0M0	Higher risk thin & Intermediate thickness melanoma	92%
Stage IIA	T2bN0M0 T3aN0M0	Intermediate thickness melanoma	80%
Stage IIB	T3bN0M0 T4aN0M0	Thick melanoma	69%
Stage IIC	T4bN0M0	Higher risk think melanoma	53%
Stage IIIA	Any TaN1-2aM0	Sentinel node positive	78%
Stage IIIB	Any Tb N1-2aM0 Any Ta N1-2b M0 Any Ta N2c M0	Higher risk sentinel node positive or Palpable lymphadenopathy or Intransit melanoma	59%
Stage IIIC	Any Tb N1-2b M0 Any Tb N2c M0 Any T N3 M0	High risk palpable nodes or Intransit metastases/satellites	40%
Stage IV	Any T Any N M1a	Metastatic disease	28%
Stage IV	Any T Any N M1b	Metastatic disease	16%
Stage IV	Any T Any N M1c	Metastatic disease	10%





began with a working party of Australian and New Zealand melanoma experts who identified the important clinical questions. For each of these questions a search strategy was developed and a systematic review of the literature was performed to identify the relevant literature which was then submitted to a structured critical review and finally the evidence was summarized and recommendations were developed including an assessment of the scientific rigour of the available evidence. These recommendations were reviewed by the entire working group and were finally released after public consultation. The aim was to produce evidence-based guidelines; however, in a number of instances where there was insufficient evidence to make definitive recommendations, a consensus opinion based on limited information and/or best advice was required.

Why are these guidelines so important and why should clinicians take notice of them? A review of patterns of care of patients with melanoma in Victoria found significant variation from Guidelines recommended care with over investigation and both under and over treatment with the potential to cause patient harm.[3] The aim of guideline development is to improve patient care by transferring knowledge to treating clinicians which is of immediate and practical value. The importance of Guidelines in improving care is well recognized and is corroborated by the large number of melanoma Guidelines published by national groups or specialist societies including the US National Comprehensive Cancer Network, European Society of Medical Oncology and United Kingdom, Dutch, French and South African Groups among others. None of these guidelines are as comprehensive or as detailed as the Australian and New Zealand Guidelines nor have most performed such a detailed and structured review of the available evidence.

To achieve the primary aim of improving care, Clinical Guidelines should be widely disseminated, easy to access, relevant and ultimately lead to change in clinician behaviour. The guideline development process should reassure clinicians that the Guidelines represent evidence-based best practice and the current publication is specifically written for the busy practitioner who manages patients with melanoma in Australia and New Zealand. In the case of early stage melanoma, compliance with guidelines is associated with both reduced post-operative wound complications and improved outcome compared with patients treated outside of Guideline-recommended care.[4] Clinicians who manage melanoma at any stage of the patient journey should at least be aware of these two publications and they should be mandatory reading for surgical trainees.

References

1. Balch CM, Gershenwald JE, Soong SJ *et al*. Final version of 2009 AJCC melanoma staging and classification. *J. Clin. Oncol.* 2009; **27**: 6199–206. (the new staging system is available online within the NCCN Melanoma Guidelines accessible at http://www.NCCN.org; updated 13/10/2010, cited 18/01/2011).
2. Australian Cancer Network Melanoma Guidelines Revision Working Party; Cancer Council Australia and Australian Cancer Network, Sydney and New Zealand Guidelines Group, Wellington. *Clinical Practice Guidelines for the Management of Melanoma in Australia and New Zealand*, 2008. [Cited 18/01/2011.] (The Guidelines as a pdf file are accessible at http://www.cancer.org.au/Healthprofessionals/clinicalguidelines/skincancer.htm)
3. Kelly JW, Henderson MA, Thursfield VJ, Slavin J, Ainslie J, Giles GG. The management of primary cutaneous melanoma in Victoria in 1996 and 2000. *Med. J. Aust.* 2007; **187**: 511–4.
4. Erickson Foster J, Velasco JM, Hieken TJ. Adverse outcomes associated with noncompliance with melanoma treatment guidelines. *Ann. Surg. Oncol.* 2008; **15**: 2395–402.

John B. Spillane,*†‡ MBBS, FRACS
Michael A. Henderson,*†‡ MD, FRACS
**Skin and Melanoma Service, †Department of Surgical Oncology, Peter MacCallum Cancer Center and ‡Department of Surgery, University of Melbourne, Melbourne, Victoria, Australia*

doi: 10.1111/j.1445-2197.2011.05961.x

History of surgical oncology in Australasia

In 1950, Klopp described the greater impact of accidental injection of nitrogen mustard into an artery rather than a vein.[1] This soon gave rise to the use of intra-arterial anti-cancer agents, firstly by surgeons and later by radiotherapists as they were traditional carers of non-haematological malignancies. However, early experiences of using anti-cancer agents in treatment of cancers that were recurrent after initial treatment by surgery or radiotherapy were disappointing. This was the case even when new anti-cancer agents were given directly into the arteries supplying the cancers with blood.[2] Most surgeons then lost interest in anti-cancer agents because they had not been effective in treating their failures, that is, recurrent localized cancers.

However, some surgeons in different parts of the world renewed their interest in using chemotherapy delivered by intra-arterial infusion as initial treatment of locally advanced cancers in a region embraced by one or two arteries that could be safely cannulated and infused, and thus deliver more concentrated chemotherapy directly to cancers before radiotherapy and/or surgery had damaged supplying blood vessels. Our team at Sydney Hospital was one such group, and in 1968 in Sydney Hospital, clinical trials were commenced using intra-arterial chemotherapy on cancers that had not previously been treated by surgery or radiotherapy.[3–6] At about the same time, Helman and Bennett began similar studies in South Africa.[7] Studies in India in treating advanced betel nut cancers confirmed our observations that best results were achieved when chemotherapy was given first, followed by radiotherapy and/or surgery in that order.[8]

Successful application and the rationale for intra-arterial induction chemotherapy conducted by the Sydney Surgical Oncology unit from the late 1960s to mid-1990s are described in detail in the introductory chapter in the book, *Induction Chemotherapy*.[9] Examples include locally advanced cancers of head and neck, skin, breast, liver and cancers and sarcomas in limbs. Techniques in management and potential problems to be avoided are discussed.

Here is one clinical example. In 1974, a patient presented with a previously untreated large cancer of his lower lip, which involved the whole lower lip and a large hard right sub-mandibular immobile lymph node mass (Fig. 1a). After 5 weeks of continuous chemotherapy by slow infusion into both external carotid arteries, the lip cancer was much smaller (Fig. 1b). The sub-mandibular lymph node mass was also much smaller. Three weeks later, radiotherapy was commenced and the outcome showed no evidence of cancer in his lip. The lymph nodes in the right side of his neck were smaller

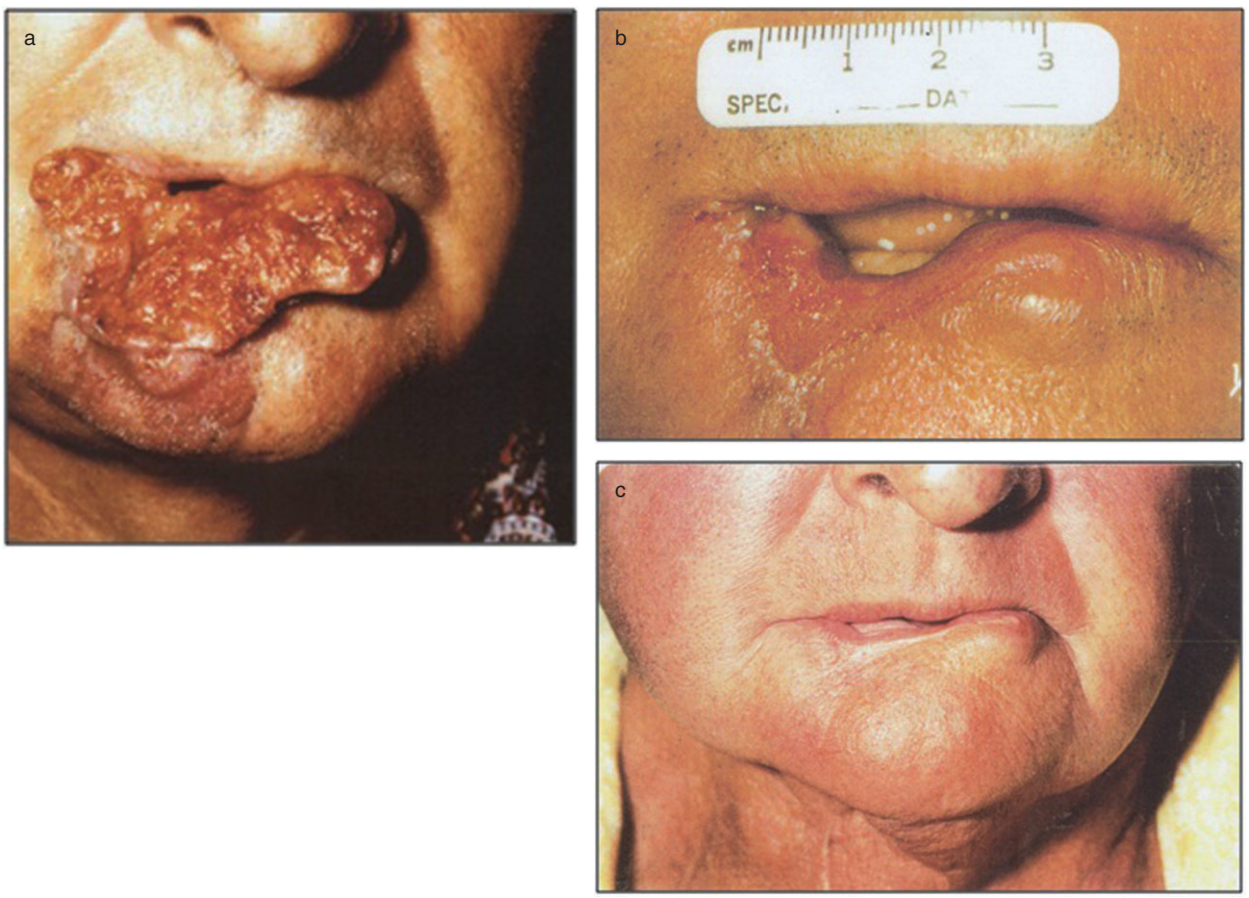


Fig. 1. (a) Advanced SCC lower lip. (b) Lower lip after five weeks continuous intra-arterial chemotherapy. (c) The same patient after completion of radiotherapy.

Fig. 2. The opening of 'Fred's Shed' in 1980.

but still palpable and were resected in a block dissection. A small nest of cancer cells was detected in two of the resected lymph nodes. This man was well with no evidence of cancer when last seen 12 years later (Fig. 1c).

Figure 2 is a photograph of the author with staff in 1980 cutting the ribbon at the opening of what we believe was the first independent surgical oncology unit in Australasia and possibly in the world (dubbed Fred's Shed). In 1982, I was invited to give the opening address at the first meeting of what became the International Society for Regional Cancer Therapy held in Giesen, Germany. This body was subsequently incorporated into the International Congress on Anti-Cancer Chemotherapy that now meets annually in Paris. After I retired, Professor John Thompson was appointed Australasian representative.

I am aware of similar work subsequently carried out by:

- Professor Bruce Grey in Perth
- the late Professor John McCaffrey in Brisbane
- Professor David Morris at St George Hospital, Sydney
- Professor John Thompson at The Royal Prince Alfred Hospital, Sydney[11]

In conclusion, I would argue, as I have elsewhere[9] and as others have,[10] for the need for a skilled surgical oncology facility to be part of any comprehensive cancer centre so that training in this specialist approach to treatment of certain cancers can be passed on.

Acknowledgements

The author thanks Prof Brendon Coventry for invitation to deliver this address at the Adelaide GSM 2011; Prof David Morris of The University of NSW for presenting this paper on my behalf; Springer Press & Wakefield Press, for permission to re-publish illustrations from *Induction Chemotherapy* (2011) and *From Kurmond Kid to Cancer Crusader* (2011).

References

1. Klopp CT. Fractionated intra-arterial chemotherapy. *Ann. Surg.* 1950; **132**: 811–32.
2. Stephens FO. Intra-arterial infusion of chemotherapeutic agents [Methotrexate and Epody] in patients with advanced localised carcinoma recurrent after radiotherapy. *Aust. N. Z. J. Surg* 1970; **39**: 371–9.
3. Stephens FO. A study of methods of improving results of surgical management of potentially curable malignant tumours. Submitted to the University of Sydney for MD Degree, March 1969, MD Conferred 1970.
4. Stephens FO. Modern trends in the surgical management of malignant disease. *Med. J. Aust.* 1972; **1**: 591–6.
5. Stephens FO. Bleomycin, a new approach in cancer chemotherapy. *Med. J. Aust.* 1973; **1**: 1277–83.
6. Stephens FO. CRAB care and cancer chemotherapy. *Med. J. Aust.* 1976; **2**: 41–6.
7. Helman P, Bennett MB. Intra-arterial cytotoxic therapy and X-ray therapy for cancer of the breast. *J. Surg.* 1968; **55**: 419–32.
8. VonEssen CF, Joseph LBM, Simon GT *et al*. Sequential chemotherapy and radiation therapy of buccal mucosa carcinoma in South India: methods and preliminary results. *Am. J. Roentgenol.* 1968; **103**: 530–40.
9. Aigner KR, Stephens FO (eds). *Induction Chemotherapy, Integrated Treatment Programs for Locally Advanced and Aggressive Cancers*. Heidelberg: Springer Press, 2011.
10. Chua TC, Crowe PJ, Morris DL. Whither surgical oncology? *ANZ J. Surg.* 2011; **81**: 763–4.
11. Thompson J, Gianoutsos M. Isolated limb perfusion for melanoma. *World J. Surg.* 1992; **16**: 277–81.

Frederick O. Stephens, AM, MD, MS, FRCS, FACS, FRACS
Former Head, Department of Surgery, University of Sydney, Mosman, New South Wales, Australia

doi: 10.1111/j.1445-2197.2011.05959.x