Available online at www.sciencedirect.com

ScienceDirect

British Journal of Oral and Maxillofacial Surgery 57 (2019) 740–742

BRITISH Journal of Oral and Maxillofacial Surgery

www.bjoms.com

Pneumatic tourniquets in maxillofacial surgery: do we need to change practice? A national study

S.D. Khandavilli [a], S. Mawji [b,*], N. Uppal [c], S. Parmar [d], P. Praveen [d], T. Martin [d]

[a] *Department of Oral and Maxillofacial Surgery, Manchester University NHS Foundation Trust, Manchester Royal Infirmary, Manchester, M13 9WL*
[b] *University of Birmingham, College of Medical and Dental Sciences, Birmingham, B15 2TT*
[c] *Department of General Surgery, New Cross Hospital, Wolverhampton, WV10 0QP*
[d] *Department of Oral and Maxillofacial Surgery, University Hospital Birmingham, B15 2TH*

Received 11 January 2019; accepted 10 June 2019
Available online 27 July 2019

Abstract

The use of pneumatic tourniquets during the harvest of free flaps is an established practice in oral and maxillofacial surgery. Their use can be associated with severe but preventable complications, for which operating surgeons are ultimately responsible. The aim of this study was to find any pitfalls concerning the safe use of tourniquets by maxillofacial surgeons. An electronic questionnaire based on the Association of Perioperative Registered Nurses (AORN) guidelines was distributed to maxillofacial surgeons nationally. A total of 37 questionnaires were completed and analysed. The mean (range) score for the knowledge-based questions for all respondents was 72.8% (47.3%–94.7%). The number of clinicians who answered correctly on topics relating to cuff position, reperfusion time and contraindications for the use of tourniquets were 15, 10 and 6, respectively. A total of 35 clinicians had had no formal training on the application of a tourniquet. Our study shows that knowledge about their use by maxillofacial surgeons is poor, and it highlights the importance of formal education during basic and higher surgical training.

Keywords: pneumatic tourniquets; maxillofacial surgery; free flaps; head and neck cancer; questionnaire

Introduction

Pneumatic tourniquets are often used to maintain a bloodless field while operating on the limbs, and during the harvest of free flaps. Together with the considerable advantages, their use is associated with few, but severe and catastrophic, complications such as deep vein thrombosis, compartment syndrome, rhabdomyolysis, and severe ischaemic injury to the fingers.[1] Although tourniquets are commonly applied by theatre assistants, the operating surgeon is ultimately responsible for any consequences that may arise from their use.

When tested on the current Association of Perioperative Registered Nurses (AORN) guidelines (maximum of 67 marks),[2] orthopaedic registrars based in the UK scored around 41.3%.[3] The authors recommended compulsory education about tourniquets and their use. The aim of our study was to assess the knowledge of maxillofacial surgeons on the safe use of pneumatic tourniquets, and to identify any deficiencies that require improvement.

Method

A multiple-choice questionnaire (supplementary data Appendix 1) was distributed electronically to oral and maxillofacial trainees and consultants nationally. It comprised general questions to find out about current practice regard-

* Corresponding author at: 254 Yardley Wood Road, Birmingham, B13 9JN. Tel.: +44 7912661875
E-mail address: sadiq.mawji@nhs.net (S. Mawji).

https://doi.org/10.1016/j.bjoms.2019.06.013

Table 1
Scores achieved by clinicians by level of training.

Level of training	Mean (range) score (%)
Consultant	73.3 (47.3–94.7)
Specialty trainees and fellows	73.6 (47.3–89.4)
Non-specialty trainees	64.9 (47.3–78.9)

ing the use of tourniquets, and specific questions based on the AORN[2] guidelines to assess current knowledge. Each correct answer was awarded one mark out of a total of 19. A minimum of 80% was needed to pass. The completed questionnaires were marked by one of the authors, and the marks entered on to a Microsoft Excel spread sheet for analysis.

Results

A total of 37 clinicians completed the questionnaires: 15 consultants, 18 registrars (specialty trainee (ST) 3 - ST7), one clinical fellow, and three dually qualified clinicians under ST3). Twelve consultants had a special interest in head and neck oncology, three did not.

Twenty-five respondents reported that tourniquets were applied by operative department practitioners or perioperative nurses, and the remaining 11 by a specialist registrar or consultant surgeon. Most respondents (n = 26) did not know if their unit followed up-to-date guidelines.

A total of 22 clinicians routinely used tourniquets for both upper and lower limb flaps, and 11 used them for upper limb flaps only. Of interest, two surgeons used them only for lower limb flaps and two did not use a tourniquet for either.

When asked if tourniquets were routinely inflated, 15 always inflated them for both upper and lower limb flaps. Fourteen inflated them for all upper limb flaps but only when required for lower limb flaps, and the remaining seven routinely applied them, but did not inflate them until necessary for either upper or lower limb flaps.

The mean (range) score for the knowledge-based questions for all respondents was 72.8% (47.3%–94.7%) (Table 1). Table 2 shows the subject areas and number of correct responses. Interestingly, 35 clinicians had had no formal training on how to apply a tourniquet, and 30 thought that some form of training was necessary.

Discussion

Pneumatic tourniquets control the circulation of blood to the limbs by application of circumferential compression and occlusion of the blood vessels. When properly applied they provide a bloodless surgical field and reduce operating time. Complications are rare, but they can be disastrous, and ultimately the operating surgeon has to face any medicolegal consequences. Formal training on pneumatic tourniquets is not usually given during basic surgical training, and 2 national studies,[2,4] which showed inadequate understanding of their use by operating surgeons, have highlighted the need for regular training.

Table 2
Number of correct responses.

Subject of question	No. of respondents
Inflation pressures	25
Adverse reactions	22
Contraindications	6
Positioning of cuff	15
Inflation gases	27
Width of cuff	30
Inflation time	25
Reperfusion time	10
Documentation	32
Tourniquet-related injury	32

We used a multiple-choice questionnaire (instead of one that required short answers) to encourage the participation of as many clinicians as possible. We recognised that the electronically distributed questionnaire may be susceptible to bias so we decided that 80% should be required to pass.

Our study has shown that most clinicians routinely use and inflate pneumatic tourniquets during the harvest of free flaps from the upper limbs, possibly because of the obvious advantages they offer, such as a bloodless surgical field and shorter operating time. Only two surgeons did not use them for either limb, but we did not establish whether this had any adverse effect on harvesting.

Analysis of the knowledge-based questions showed that a mean score of only 72.8% was achieved and this was considerably lower than the accepted pass mark of 80%. Questions on the gases used for inflation, inflation times, and adverse reactions, were generally answered well, but important questions on the application of a tourniquet, inflation pressures, reperfusion time, and contraindications, showed poor overall knowledge (Table 2). We acknowledge, however, that our questionnaire was not validated and our sample size was small.

Although tourniquets are commonly placed by an operating department practitioner or perioperative nurse, we think that operating surgeons should ensure that they are properly applied and inflated. Nearly all the clinicians had had no training on how to apply them and most thought that formal teaching was necessary during surgical training. We could not find any standard UK guidelines by the National Institute for Health and Care Excellence (NICE) or Scottish Intercollegiate Guidelines Network (SIGN) on the application of a tourniquet. Guidance from organisations such as AORN or the Association of Surgical Technologists (AST) can be adopted if no local or regional policies are available.

In conclusion, our study has shown a considerable gap in knowledge among maxillofacial surgeons with regards to

the use of pneumatic tourniquets, and we recommend formal training and assessment on their use during basic and higher surgical training. This can be achieved through didactic lectures, hands-on training in the operating theatre, and regular web-based assessments. We hope that this will not only reduce potential complications but also improve our patients' safety.

Conflict of interest

We have no conflicts of interest.

Ethics statement/conformation of patients' permission

Not required.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.bjoms.2019.06.013.

References

1. Sharma JP, Salhotra R. Tourniquets in orthopedic surgery. *Indian J Orthop* 2012;**46**:377–83.
2. AORN Recommended Practices Committee. Recommended practices for the use of the pneumatic tourniquet in the perioperative practice setting. *AORN J* 2007;**86**:640–55.
3. Sadri A, Braithwaite IJ, Abdul-Jabar HB, et al. Understanding of intra-operative tourniquets amongst orthopaedic surgeons and theatre staff – a questionnaire study. *Ann R Coll Surg Engl* 2010;**92**:243–5.
4. Daruwalla ZJ, Rowan F, Finnegan M, et al. Exsanguinators and tourniquets: do we need to change our practice? *Surgeon* 2012;**10**:137–42.