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SAFE USE OF INTRA-OPERATIVE TOURNIQUETS IN A DISTRICT HOSPITAL IN THE UK—AN AUDIT STUDY IN ORTHOPAEDIC THEATRES AND REVIEW OF CURRENT LITERATURE


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Abstract.

The use of tourniquet is common in orthopaedic surgeries as it reduces blood loss, enhances visualization of the operating field, and leads to quicker procedures. However, the use of tourniquet has certain risks which can be avoided by following guidelines like British Orthopaedic Association Standards for Trauma (BOAST) guidelines for safe use of tourniquet. This audit study was done in a District general hospital to check the compliance of two trauma theatres with BOAST guidelines. The audit found that there was poor documentation of tourniquet details in the operation notes (10%). Regarding tourniquet time and pressure, the compliance in the two theatres was 95% & 97.5%. The recommendations of this audit were to use a template to improve documentation of tourniquet details in the operation notes and training of theatre staff on BOAST guidelines for safe use of tourniquet.

Key words. Tourniquet, safe use guidelines, BOAST, orthopaedic trauma, theatres.

Introduction.

The tourniquet is an externally applied device to a body part to occlude the underlying blood flow and used in orthopaedic surgeries. The main advantage is reduced blood loss during surgery and also enhances the visualization of the surgical field and reduces operative time. For effective use of tourniquet, the tourniquet pressure should be greater than the arterial blood pressure of the limb [1,2]. The pressure required to stop arterial blood flow in a limb is called the limb occlusion pressure (LOP) or the arterial occlusion pressure (AOP). LOP is measured by serial inflation of pressure cuff until loss of arterial pulse of the limb on doppler ultrasound [2-4].

However, the use of tourniquet is associated with several risks such as nerve injuries (most common complication) [5], compartment syndrome [6], rhabdomyolysis [7], pressure sores, digital necrosis, chemical burns [8], deep vein thrombosis leading to pulmonary embolism [9], tourniquet pain [10].

The British Orthopaedic Association Standards for Trauma (BOAST) has set guidelines for safe use of intra-operative tourniquets, and it provides specific recommendations regarding safe limits of tourniquet pressure and duration. The BOAST guidelines also recommend clear documentation regarding skin site.

In our audit study, we aimed to check the compliance with BOAST guidelines during use of tourniquet in orthopaedic theatres in a District General Hospital in the UK [11].

Materials and Methods.

The study was a retrospective audit conducted in the orthopaedic theatres at Worthing Hospital. The audit was registered with the hospital audit department with registration number 1661. The audit was a retrospective analysis of 40 patients each from two trauma theatres (Theatre 8 & Theatre 9) from March 2022 till June 2022. The data was collected from theatre record books along with operation notes.

The data collected included patient name, age, sex, type of procedure and indication, the tourniquet pressure used and the tourniquet time and documentation of skin site. The study included only orthopaedic trauma patients and elective cases were excluded from the study.

Results.

In theatre 8, 21 patients had upper limb surgery with an average tourniquet time 45 minutes and 19 patients had lower limb surgery with an average tourniquet time of 56 minutes. In Theatre 9, 19 patients had upper limb surgery with an average tourniquet time of 54 minutes and 21 patients had lower limb surgery with an average tourniquet time of 73 minutes.

In theatre 8, 39 out of 40 patients had a tourniquet time less than 120 minutes (compliance rate of 97.5 percent). In one case where tourniquet time was exceeded there was no documentation of the tourniquet time in the operation note and no justification regarding the need to go above 120 minutes as per BOA guidelines.

In theatre 9, 38 out of 40 patients had a tourniquet time less than 120 minutes (compliance rate of 95 percent). There was a mention of tourniquet time being of 139 minutes for one of the operations, but no justification was given. The other operation where the tourniquet time was noted as 132 minutes in the theatre record book had some discrepancy with the operation note, where the tourniquet time was recorded as 95 minutes.

The results showed that there was poor documentation regarding the tourniquet time and duration in the operation notes as only 10% of the operation notes had this information. The theatre record book contained most of the data.

With regards to compliance with BOAST guidelines with respect to tourniquet pressure and time, theatre 8 had 97.5% compliance and theatre 9 had 95% compliance (Figure 1). In none of the theatres there was any documentation justifying the cause of increased duration of tourniquet time. Also, there was no documentation of tourniquet site.

Discussion and Review of Literature.

The use of tourniquet has led to less blood loss during limb surgery and also better visualization of the operative field leading to quicker procedures which is beneficial for the patient and improves outcomes. However, the use of tourniquet is associated with various complications like nerve injuries (most common complication) [5], compartment syndrome [6],
Before application of tourniquet, the pressure source, cuff, regulator, and tubing with connectors should be checked. Wider cuffs have better transmission of pressure during tissue compression and have lower chance of pressure related complications. Also, wider cuffs were less painful than narrower cuffs [14].

Documentation of tourniquet time and pressure is vital particularly in operation notes. The compliance with operation notes was variable in different studies. In two studies done in Hongkong and in India the documentation of tourniquet time and pressure in operation notes was poor with compliance of 32% [15] and 42 % [16]. Another study found that the introduction of an operation note template improved documentation of tourniquet time by 49 %.In our study the documentation of tourniquet details was poor with only 10%. As a recommendation on improvement in documentation of tourniquet details, an operation template is the best way to improve documentation.

Regarding compliance with BOAST guidelines with respect to tourniquet pressure and time, in study by Vayalapra et al showed compliance of 97 % in both their audit cycles [2]. In our study the compliance was 95% in theatre 9 and 97.5% in theatre 8. In cases where tourniquet time was exceeded no clear documentation was done either in operation notes or in theatre record book. In previous studies the main reason for this is lack of awareness regarding BOAST guidelines in theatre personnel. Also, there is a tendency to use standard tourniquet inflation pressure instead of calculating the pressure as per the systolic pressure. Studies have shown that there is a lack of formal training of staff on BOAST guidelines on safe use of tourniquet [2,17,18,19].

**Conclusion.**

The audit study concluded that there was lack of documentation on tourniquet details particularly in the operation notes. This problem can be effectively mitigated by using an operation template. In cases where the tourniquet time was exceeded there should be documentation justifying the need for that. The compliance with regards to tourniquet pressure and time was good and comparable with other studies, however that can be improved by proper training of staff on safe use of tourniquet. The lack of awareness can be solved by organizing regular training courses for theatre staff. Our audit study was a single cycle of an audit, so a reaudit after implementation of recommendations is necessary.

**REFERENCES**


**Figure 1.** Compliance with BOAST guidelines with respect to tourniquet time in Theatre 8 and Theatre 9.

rhabdomyolysis [7], pressure sores, digital necrosis, chemical burns [8], deep vein thrombosis leading to pulmonary embolism [9], tourniquet pain [10].

The limb should be exsanguinated by simple elevation or by use of an Esmarch bandage or tourniquet exsanguinators which empties the blood vessels distally to the proximal part of the limb before inflation of the tourniquet. This creates a clear operating field, reduces blood loss, and decreases the risk of micro emboli at the time of release of tourniquet. Exsanguination provides a mode of autotransfusion of blood into the central circulation [1]. The optimum time and angle of elevation for maximum effect of exsanguinations of upper limb is 5 mins at 90 degrees [12] and for lower limb is 5 mins at 45 degrees.

After inflation of tourniquet there is progressive cellular hypoxia, acidosis and decrease in temperature of the occluded limb. The muscle is more susceptible to ischaemia than the nerve. Under tourniquet muscle has reduced pH and pO2, increase in pCO2, K+ and Lactate. There is evidence of tissue edema if tourniquet is used more than 60 mins [1]. Tourniquet pain develops in 66% patients after 30-60 mins of tourniquet use [13].
16. Tuteja S, Tiwari A, Bhanushali J, et al. Results of an audit of orthopaedic operation notes from a tertiary care centre: are we doing it right and can we do more?. Indian J Orthop. 2022;56:2223-7.