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Review Article

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A review of the use of the tourniquet in limb surgery

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Abstract

Most orthopedic operations utilize tourniquets frequently, but because they frequently cause major complications, we decided to study and approve their safe usage and teaching. We looked through full-text English papers and non-English article abstracts while conducting searches for "tourniquet" in PubMed and Google. Additionally, we browsed through every article's reference page in search of fresh sources. When used properly, the tourniquet can be used to avoid major but uncommon complications that can occur when it is used during orthopedic surgery. There isn't enough proof right now to stop using tourniquets regularly.

Keywords: orthopedic surgery, limb, tourniquet

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Introduction

A tourniquet is a tool that makes surgeries significantly simpler by preventing blood flow to the limbs. Although it is used by everyone, there are still many disagreements about it, and over time some of the underlying principles have evolved. The application of a tourniquet may be risky and even harmful in some circumstances. We shall examine the background and application of this item in this review essay.

History

Sushruta, the founder of surgical art and science, is credited with making the first attempts to stop arterial bleeding in 600 B.C. He is reported to have employed a tool that we now refer to as the tourniquet at the time, pressing the arteries with pieces of leather that he had manufactured himself (1). The application of a tourniquet, which stops blood flow into and out of the leg, has historically been very near to amputation. During the reign of the Roman emperors, the tourniquet was first applied in 200 BC and was continued until 500 A.C. (2). The goal at the time was to save the lives of warriors or patients who were limb-impaired, and bronze rings or leather tools were employed to accomplish this.

Types

Tourniquets come in two general categories: emergency and surgical. In orthopedic and plastic surgery, tourniquets are used to stop the flow of blood, increase safety and precision, and make the procedure easier for the surgeon. In times of emergency, such as during battle, tourniquets are used to stop bleeding.

Use of tourniquet

When performing delicate hand surgeries, using a tourniquet is sometimes a luxury while at other times it is a necessity. The use of a tourniquet during surgery aids in the creation of a blood-free area improves the surgeon's visibility, and, in theory, shortens the surgical procedure (3). The tourniquet does not speed up surgery, according to at least one study on knee arthroscopy (4) and one systematic review on upper limb surgery (5). Although it was once stated that the tourniquet should be applied to the top of the limb, forearm (6), leg (7), wrist, and ankle tourniquets are now frequently used.

Some techniques to extend the safe tourniquet time

1. Breathing time must be taken into account if the surgery is expected to take more than 3 hours, and the tourniquet is often relaxed for 30 minutes after 2 hours (8).

2. The safe time of the tourniquet can be extended up to 4 hours by using multiple tourniquet cuffs and intermittently removing one (9).

3. It is reasonable to chill the limb in conjunction with extending the safe duration of the tourniquet, as has been shown in animal (10) and human (11) research, but it is not straightforward or feasible to cool the tissues throughout the procedure.

Complications

Tourniquet discomfort is a well-known consequence that can be brought on by mechanical pressure and the ischemia-reperfusion pathway (12). Involvement of the central nervous system is undoubtedly possible (13). One study found no correlation between pain and cuff width or tourniquet pressure (14), but another found that using lower-wide cuffs causes milder discomfort that lasts longer (15). Although they can happen in the lower limb as well, neural injuries are most frequently reported in the upper limb. Simple paresthesia to complete paralysis is on the spectrum of neural injuries. These are unusual. Their incidence was reported to be 0.024% in a large study, and of the 15 reported injuries, 13 spontaneously healed after six months (16). The incorrect operation of

the tourniquet gauge may result in serious injuries and some tourniquets have been discovered to apply as much as 500 mmHg greater pressure to the limb than what was suggested (17). It happens frequently for a tourniquet gauge to be inaccurate. It is debatable if the application of a tourniquet, which causes temporary ischemia in the limb, can alter how a fracture surgery turns out. Tourniquets did not appear to have any negative effects in one investigation on tibia fractures treated with plates and screws. Since it may cause severe burning bone necrosis (18), the use of a tourniquet when reaming the canal of a fractured tibia for the placement of intramedullary nails is absolutely contraindicated, though this has been called into question by at least one study (19). Relative contraindications to using a tourniquet include peripheral vascular disorders in which the end limb pulses are not perceptible. It is not advised to use tourniquets on people who have a congenital vulnerability to nerve compression. Tourniquets should only be used with extreme caution in patients with neuropathies, systemic lupus erythematosus, underlying coagulation problems, and cachectic individuals (20).

Conclusions

Although very sophisticated devices have been developed, the risk of using tourniquets during limb surgery has not been eliminated. Therefore, using it would require the utmost care. There is currently no evidence to support the removal of tourniquets during limb procedures, but it is clear that further research is necessary in specific situations, such as those involving minors and patients with sickle cell anemia.

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