

## BLOOD SUPPLY

Terms you will become familiar with in this section of the module

ischaemia	diathermy
anaerobic bacteria	irrigation
necrosis	intra-articular shaver
thrombosis	debrider
arterioles	cryocuff
cardiac arrest	arthroscopy
fibrillation	pneumatic
electrocardiograph	orthopaedic
end tidal carbon dioxide	sterile field
pulse oximeter	meniscus
tourniquet	meniscusectomy

### INTRODUCTION

When blood flow is stopped, oxygen cannot be delivered to the cells that the tissues are made from [**ischemia**] and they begin to die. The cells begin to decay and, very quickly, bacteria which do not need oxygen to survive [**anaerobic bacteria**] take advantage of the lack of oxygen to multiply and feed off the decaying cells. As a result, the death of the cells results in the release of toxic by-products into the tissues and tissue death [**necrosis**] begins.

Blood flow to a particular part of the body can be stopped by a blood clot [**thrombosis**] blocking very fine blood vessels [**arterioles**] which feed sensitive tissues [eg the brain]. Total stoppage of blood flow may occur when the heart stops pumping [**cardiac arrest**] or when the heart muscle goes into uncontrolled spasms [**fibrillation**]. Blood flow can be stopped deliberately under clinical conditions to arrest uncontrolled bleeding, to measure blood pressure or to stop blood flow through operating sites.

## Activity

Use the diagram of a knee joint to identify and label the parts listed in the key

quadriceps muscle  
meniscus  
patella  
medial disk  
anterior cruciate ligament  
posterior cruciate ligament  
synovium

## Questions

How is each of these structures important for knee function?  
These structures are often damaged in sport injuries. What common types of injuries occur to each of these structures?  
Which injuries are non-reversible [do not heal with reasonable care and time]?

## Case Study

Equipment which is *emphasised*, referred to or used in this case study includes:

### Monitoring

- ECG
- End Tidal CO2 monitor
- Blood pressure monitor
- Pulse oximeter

### Haemostatic

- anaesthetic machine
- *Tourniquet*
- Diathermy

Diagnostic

- Telescopes
- *Light source*
- Camera
- Monitor
- Irrigation system

Therapeutic

- Intra articular shaver/debrider

Rehabilitation

- Cryocuff

Mr Jones is a 42 year old man operating a carpentry business which he shares with a partner. He injured his knee playing football with his 3 sons almost a year ago. Since then his knee locks at odd moments and he still get sharp pains.

Mr Jones has been told he should have an **arthroscopy** [pronounced arth-ross-cop-ee] which is a simple operation for looking into the knee joint through a telescope. Only two small holes will be made and the problem will be repaired using specially designed instruments.

**Questions**

Telescopes are commonly used for seeing things at a distance. How is this telescope different from an astronomical telescope? Does the structure of the telescope create any problems for its use in sterile operation areas? If one telescope is being used, why are two holes needed for the arthroscopy?

Mr Jones arranges with his partner to take some time off work and goes to medical centre on Tuesday morning having fasted since 10pm the night before. After a shower, he is transferred to the operating suite at 11am. Mr Jones is given a general anaesthetic using an anaesthetic machine and when he is asleep, he is positioned appropriately for the procedure. A **pneumatic tourniquet** [pronounced new-matic torn-ick-ay] is applied to his upper thigh so that the circulation to his lower leg will be minimised and no bleeding will occur that might ruin the view of the knee joint through the telescope.

## Questions

How long can a tourniquet be safely left inflated without causing damage to the limb?

What inflation pressure is required to restrict the flow of arterial blood into the leg?

## Activity

Find out how many tourniquets are used in the operating suite of your medical centre and what type of maintenance routine is in place.

Speak to the nurses who work, or have worked, in orthopaedic and plastic surgery and find out what types of procedures require a tourniquet.

The knee is prepared by the operating team and a sterile area [field] is created so that the knee can be operated on without introducing any bacteria into the wounds. While this is being done, Mr Jones status is being monitored with an electrocardiograph, an End Tidal CO<sub>2</sub> monitor, a Blood pressure monitor and a Pulse oximeter.

A sterile video camera is connected to a video monitor and a sterile light lead is connected to a light source to illuminate the knee joint through the telescope. The video camera is attached to the eye piece of the telescope and the internal structures of the knee joint can be viewed on the monitor by the doctors and nurses in the operating room.

The meniscus of Mr Jones knee is badly torn and the surgeon needs to remove the torn piece in order to reduce the problem of the locking knee.

While the operation is in progress, the monitor image begins to break up, stabilise and break again. It finally fades to a bright spot in mid-screen. The staff in the operating room cannot sort out the problem and they don't have access to a spare monitor so they telephone to you for help. If the monitor cannot be repaired, the operation will only be able to continue if the surgeon looks directly into the eye piece. This is a technique he has never practised before and it will be very difficult to keep the operating field sterile.

The tourniquet has already been inflated for 45 minutes so you hurry to the operating suite, change into operating suite attire and go to the operating room.

### Questions

Why is there a need to hurry?

What checks of the equipment will you make first?

Why is it more difficult to keep the operating field sterile if the surgeon has to look through the telescope directly?

You replace the monitor. The surgery continues and a **meniscectomy** is performed. The surgeon decides to use the **intra-articular shaver** to trim some ragged **synovium** and this equipment all works perfectly.

When the surgery is complete and the knee joint has been **irrigated** to wash out any shavings and other debris from the procedure, dressings are applied and a **cryocuff** is applied to the knee to minimise swelling by post-operative cooling.

### Questions

Suggest ways in which the light failure might have been prevented. Which of these is not practical and why?

What routine maintenance procedures could be used at the completion of the operation to ensure that all equipment will be working efficiently for the next arthroscopy?

### Activity

Visit the Recovery Room [Post Anaesthetic Care Unit] in your operating suite or day surgery centre and find out how patients are managed after arthroscopy in your institution.

What mechanical devices are used to aid recovery? Are these devices only available in medical centres? Are all of the available devices used in your medical centre?

Mr Jones returns to the ward and is allowed to go home that evening on crutches. He makes a good recovery and returns to work after 10 days - much to his partner's relief. His knee is now functioning normally.