Belfast Health and Social Care Trust
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Ulster University

Amputation Outcomes & How to Perform a TKA

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Northern Ireland Vascular Trainee Teaching Program – 28th February 2018

Royal Victoria Hospital

respect & dignity openness & trust leading edge learning & development accountability

THE WORLD UNIVERSITY RANKINGS 2017 TOP 150 YOUNG

Peripheral Arterial Disease

- 20% of people over 55 years of age.
  - Hankey GJ, *JAMA* 2006
- 27 million people affected in Europe and USA.
  - Hankey GJ, *JAMA* 2006
- Only 10-30% of patients will have symptoms.
  - McDermott MM, *Cleve J Clin Med* 2006
- Symptoms deteriorate in 25% of patients.
  - Schmieder FA, *Am J Cardiol* 2001
- 2% to 4% will require amputation.
  - Dormandy J, *Semin Vasc Surg* 1999

Diabetes

- 15% affected by PAD at 10 years rising to 45% at 20 years.
  - Kreines *Diabetes Care* 1985.
- 20% of patients with PAD have diabetes.
  - Muribato *Circulation* 1997.
- PAD disease distribution different in diabetes.
  - Strandness *Diabetes* 1961.
- 11-times higher rate of major lower limb amputation and a doubling of the five-year mortality.
  - Elhadd *Pract Diabetes Int* 1999.
- Diabetic ulcers heal more slowly leading to increase amputation rates.
  - Caputo *N Engl J Med* 1994.

Learning Outcomes

- Explore Background, Indication and Overall Philosophy of Limb Amputation.
- Types of Amputation.
- Through-Knee Amputation Technique.
- Personal Technical Tricks.
- Royal Blackburn Case Volume and Outcomes.
- Future Strategy.

No. 131. Gersdorff. Wundarznei. Strassburg, 1517-8.
(Reduced.)

Epidemiology

- Peripheral arterial disease accounts for the majority of lower limb amputations in the Western World.
  - Greater than 80% due to vascular disease in UK.
  - Six times higher in insulin dependent diabetic patients.
  - Epicentres based on location and population demographics eg. South Western USA & Navajo population.

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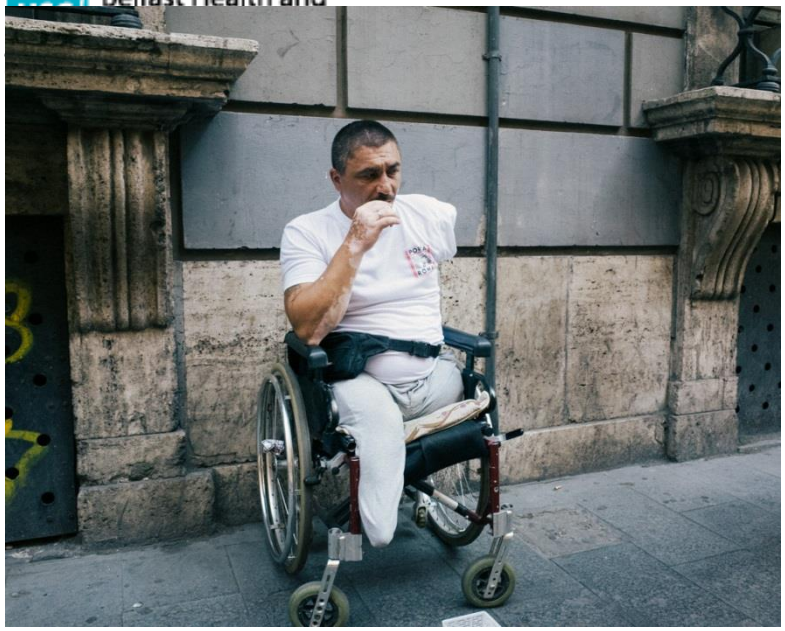
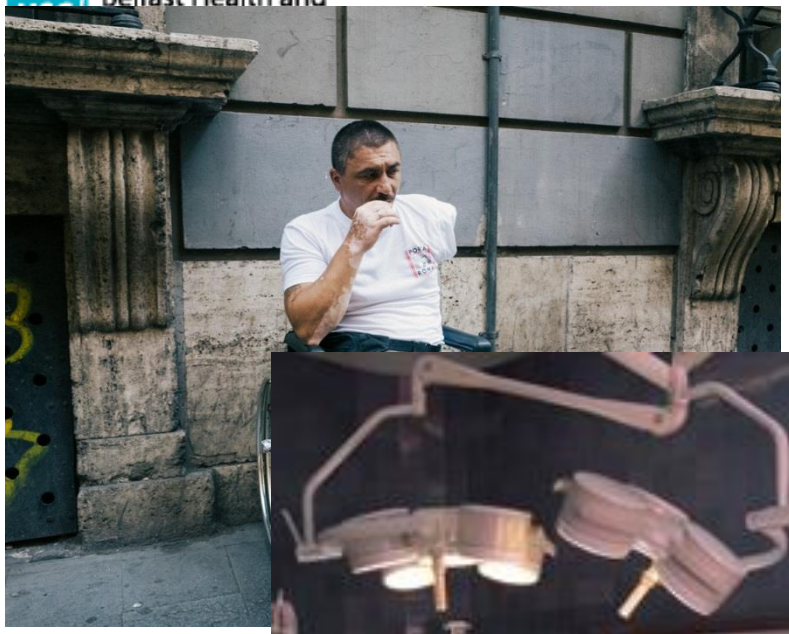
- National Amputee Statistical Database reported that dysvascularity responsible for 70% of all lower limb prosthetic referrals in 2006-07.
  - 4574 referrals post-lower limb amputation.
  - 53% transtibial.
  - 39% transfemoral.





Impact of Modern Surgery

- Danish National Amputation Register demonstrated a 27% fall in major limb amputations due to increased utilisation of infra-inguinal bypass operations.

- Similar reports from Finland, United States and other Western Countries.

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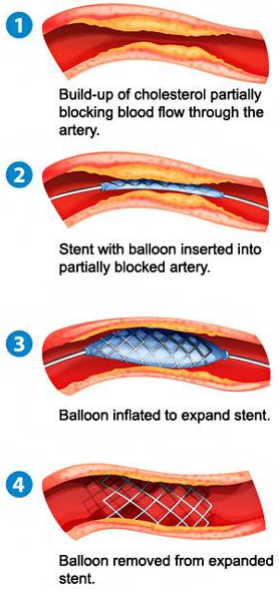

Survival following Major Limb Amputation

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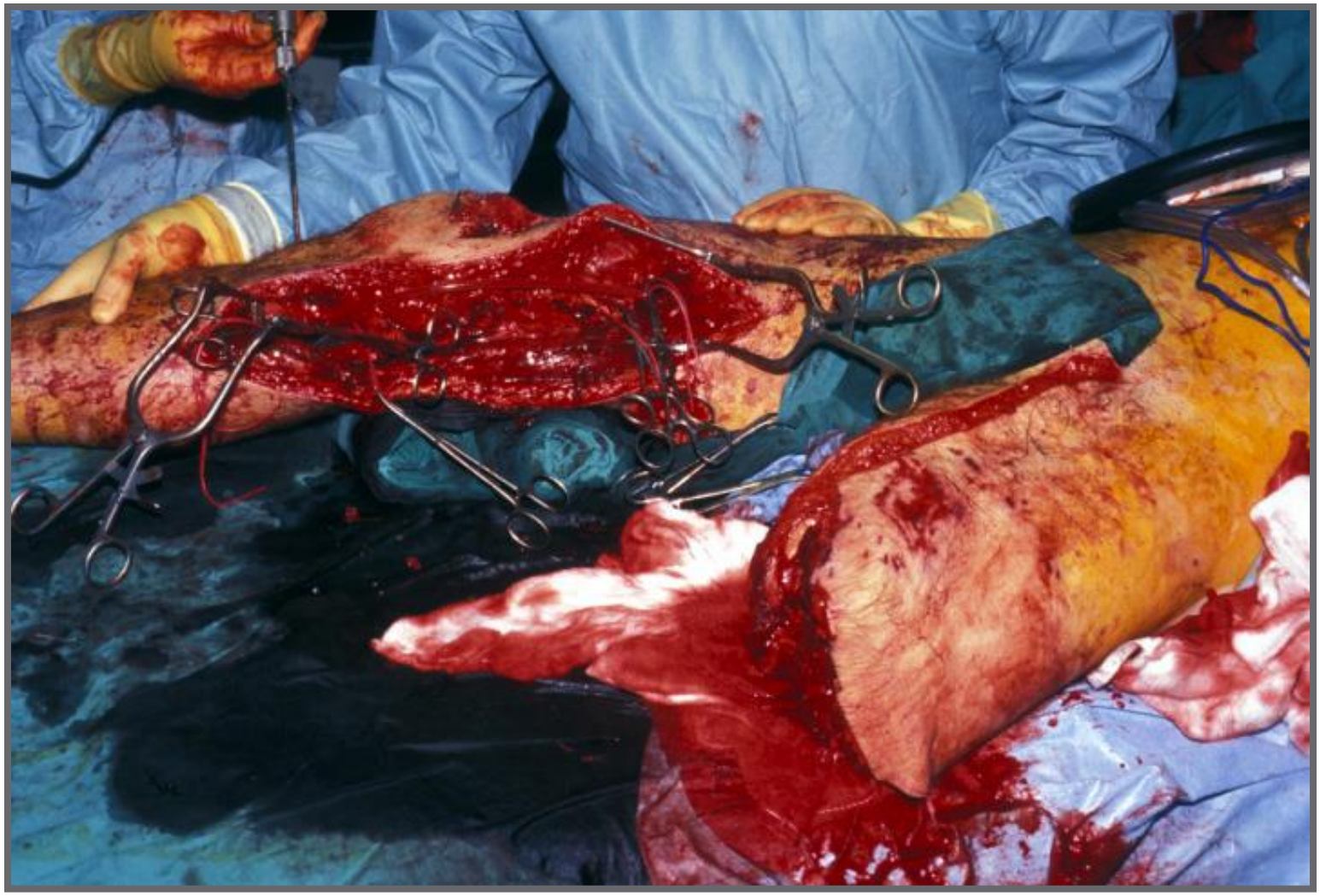
  - If patient survives initial traumatic episode long-term survival is good.



Outcomes following Major Limb Amputation

- Mortality rates post-amputation remain bimodal.
  - For PAD patients, mortality rates are significantly affected by their underlying cardiovascular disease burden.

Vascular Disease – What Lies Beneath

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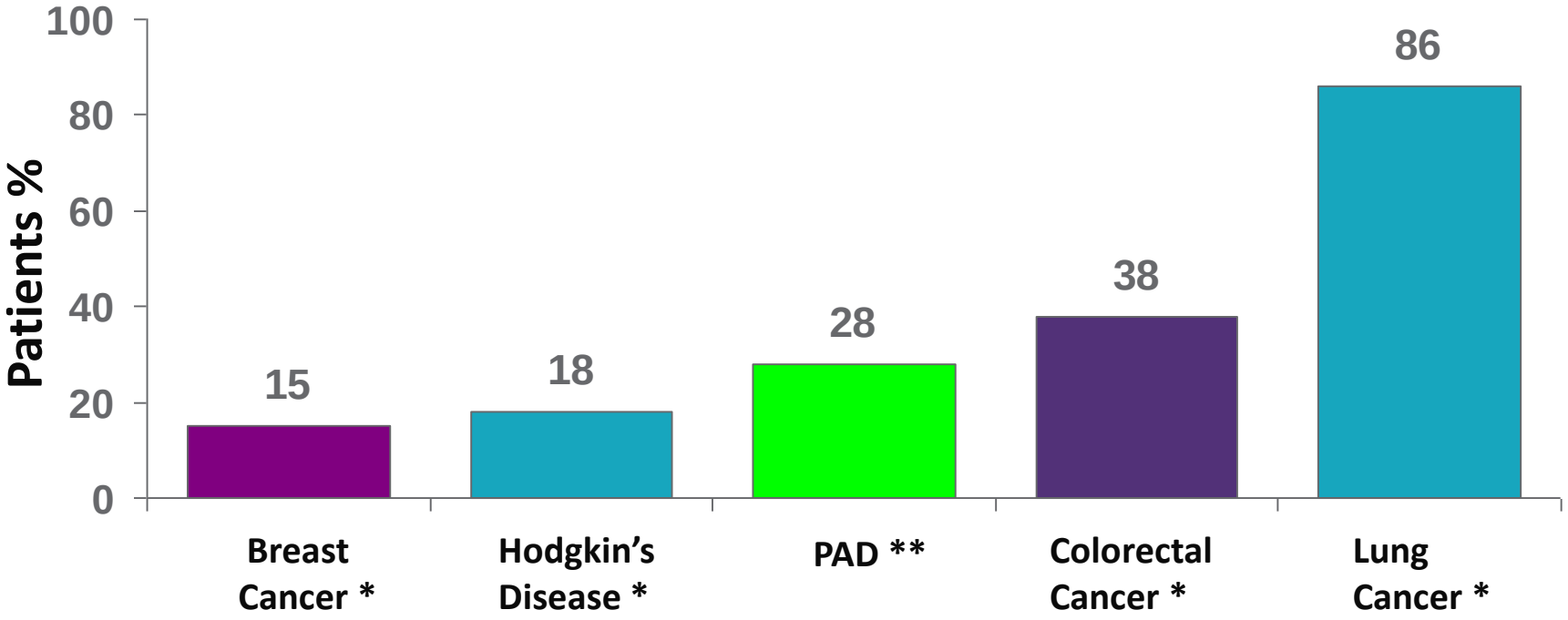
Outcomes following Major Limb Amputation

- Mortality rates post-amputation remain bimodal.
  - For PAD patients, mortality rates are significantly affected by their underlying cardiovascular disease burden.
  - 30-day mortality between 9% and 15%.
- **Annual deterioration in long-term survival;**
  - **60% at one year.**
  - **42% at three years.**
  - **35% - 45% at five years.**

Relative 5-Year Mortality Rates



* American Cancer Society. *Cancer Facts and Figures*. 1997.

** Kempczinski, RF, Bernhard VM. IN: Rutherford RB, ed. Vascular Surgery. Philadelphia, PA: WB Saunders; 1989: chap 53.

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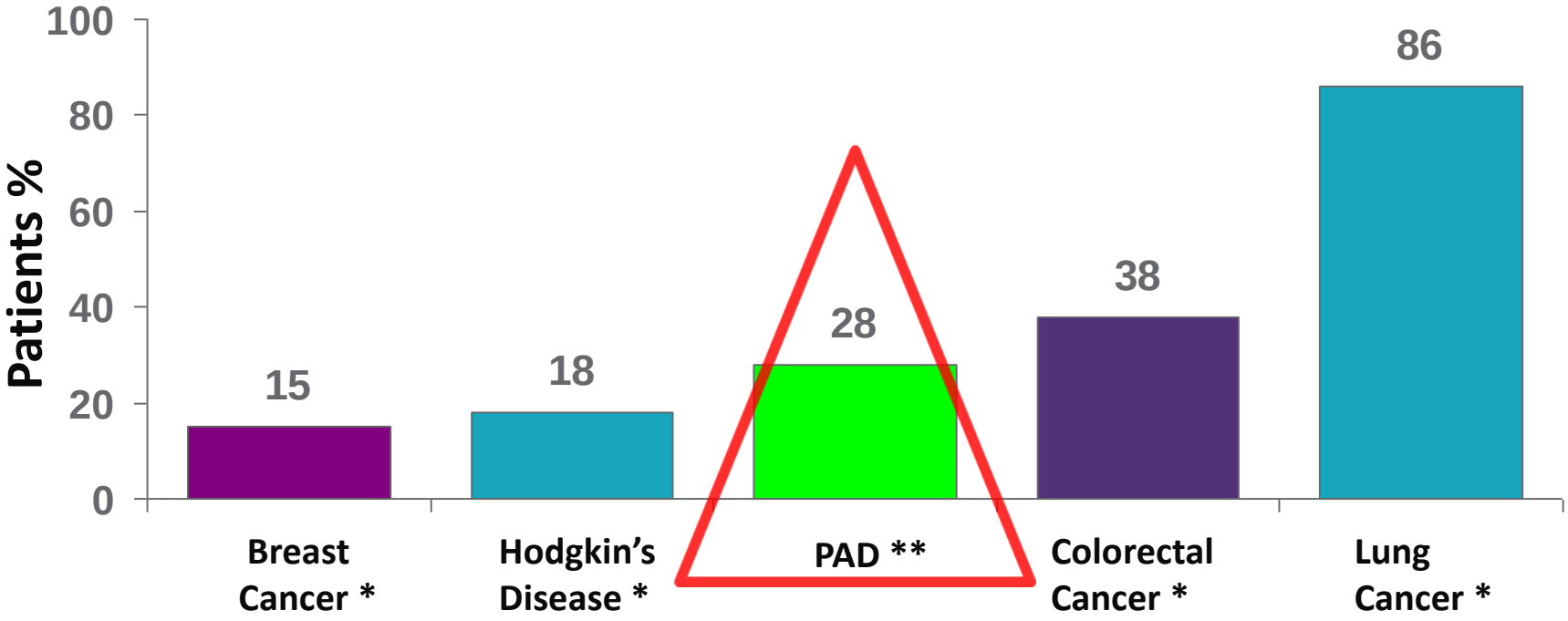

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Surgical Philosophy

- Emergent status.
- Spectrum of disease severity;
  - No tissue loss extending to gross macroscopic destruction.
- Patient co-morbidities.
- Revascularisation possible.
- Rehabilitation potential.

Vascular Amputation – The Horror !!!!

Surgical Considerations

- Handle tissues with care and optimise haemostasis.

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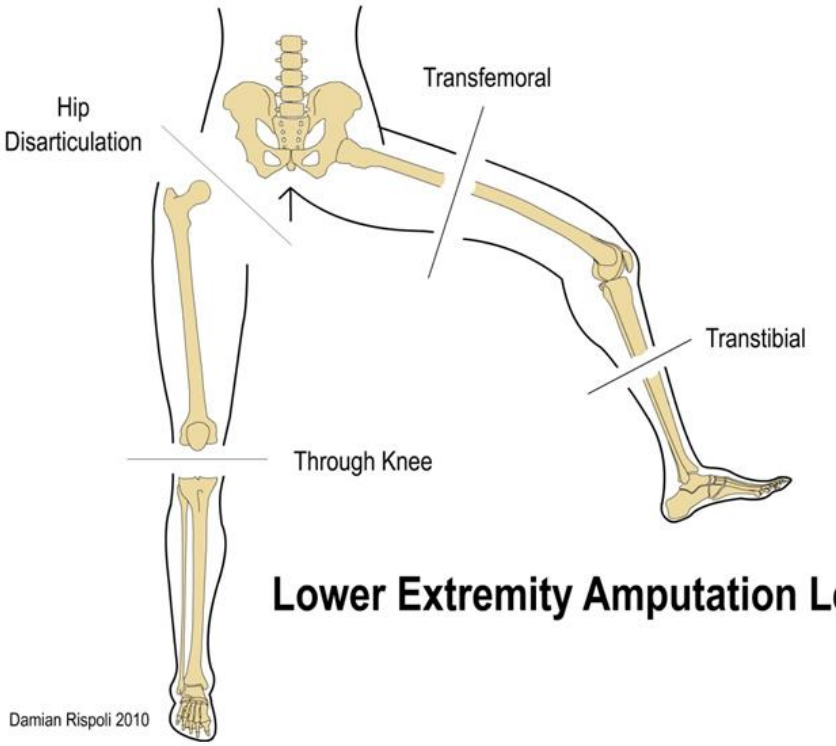
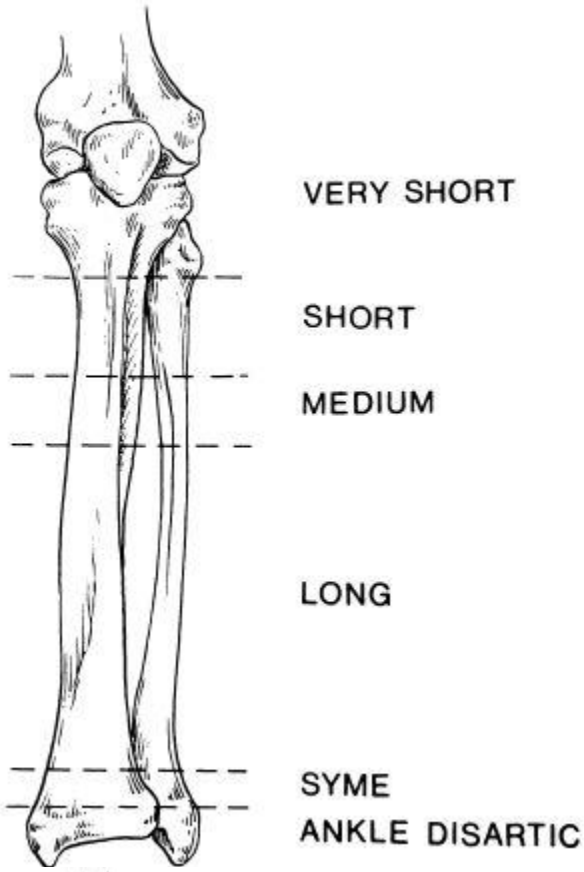
- Protect good quality skin and cover stump without tension.
- Bone edges should be bevelled and smoothed out.
- Think of stump shape for future prosthetic use.
- Tourniquet usage as per surgeon preference.

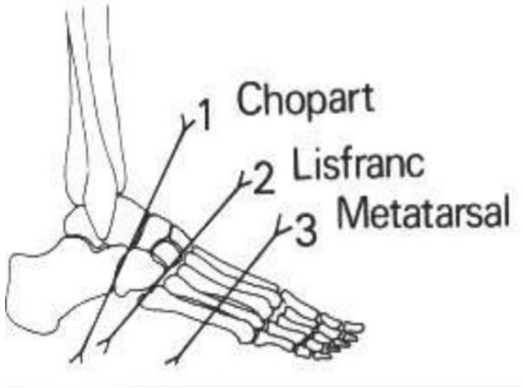
Optimisation of Wound Healing

- Patient optimisation including MRSA screening.
- Antibiotic prophylaxis in accordance with local protocols.
- Patient physiology:
  - Normothermia.
  - Maintenance of glucose homeostasis.
- Operative technique:
  - Pre-operative patient washing ??
  - Anatomical marking.
  - Aseptic technique and precise tissue handing.
  - Theatre sterility and laminar air-flow.



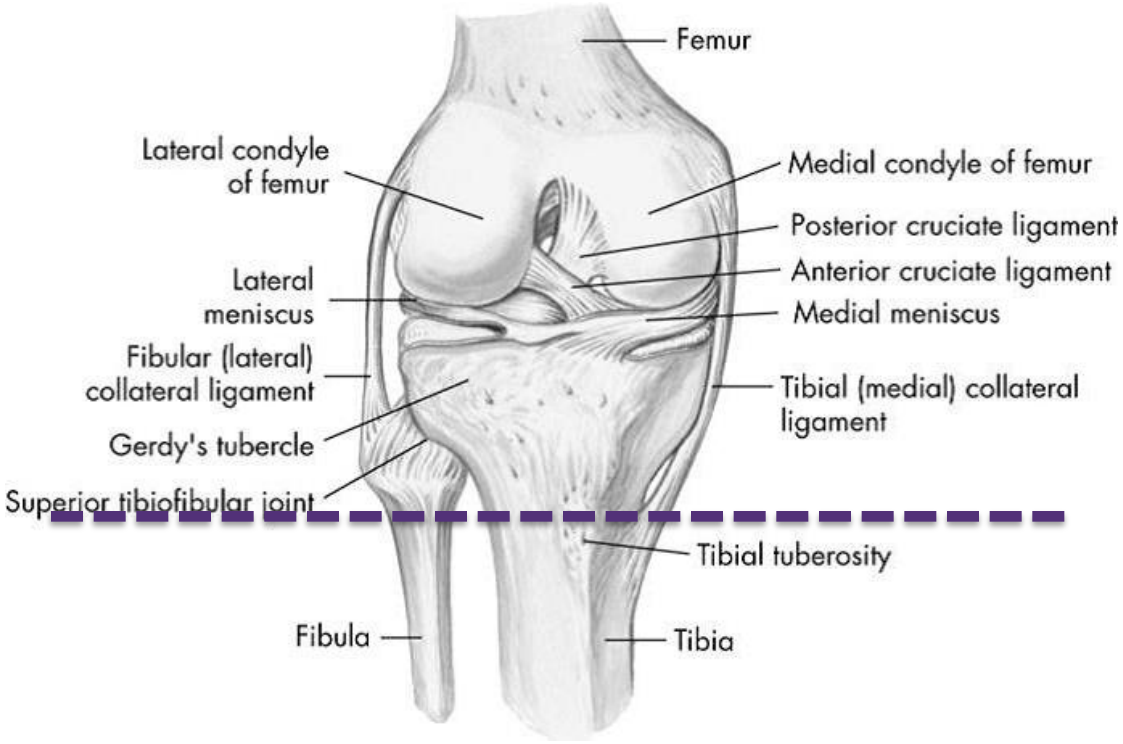
Lower Extremity Amputation Level





Through Knee Amputation

1 – Skin Marking



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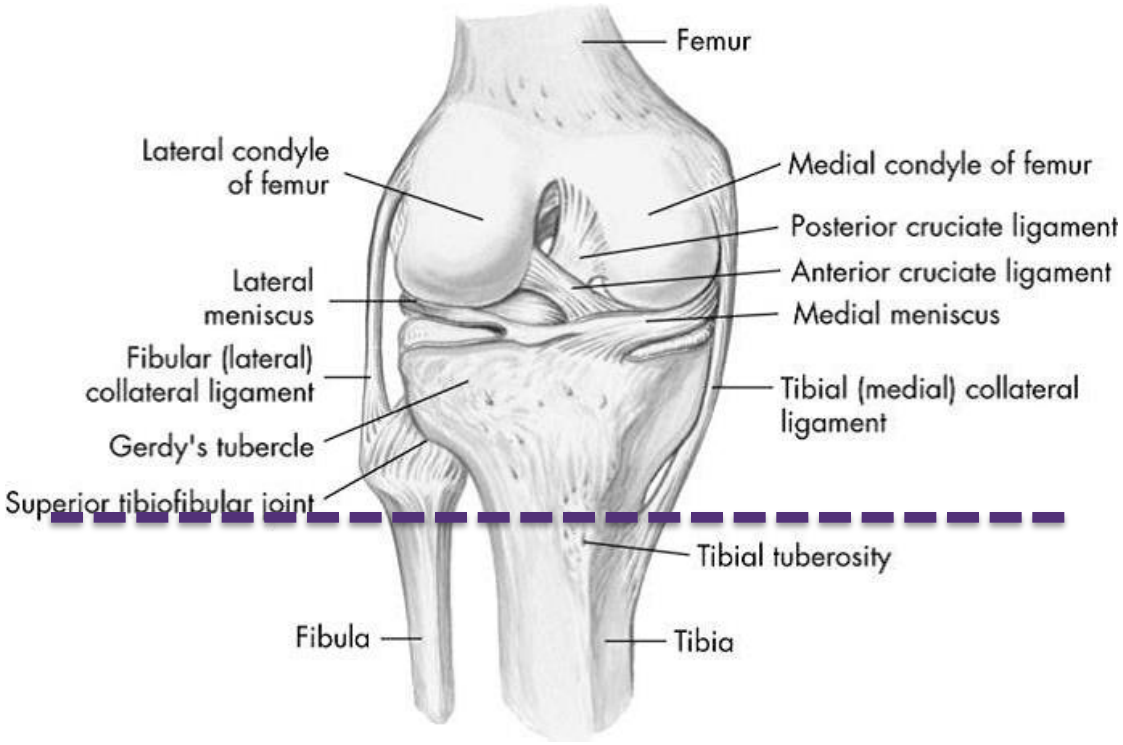

2 – Anterior Incision

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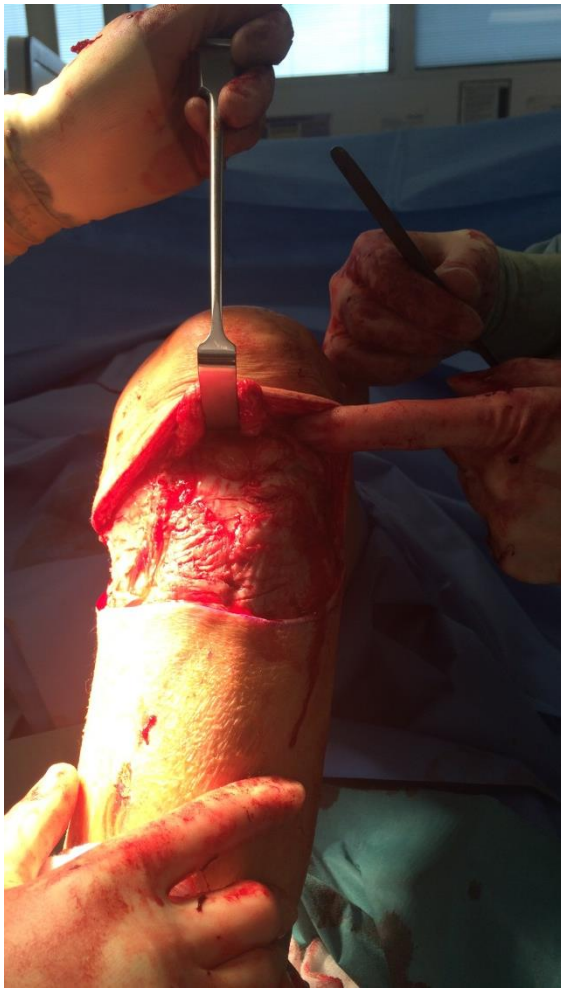

3 – Posterior Flap

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4 – Menisci + Cruciates

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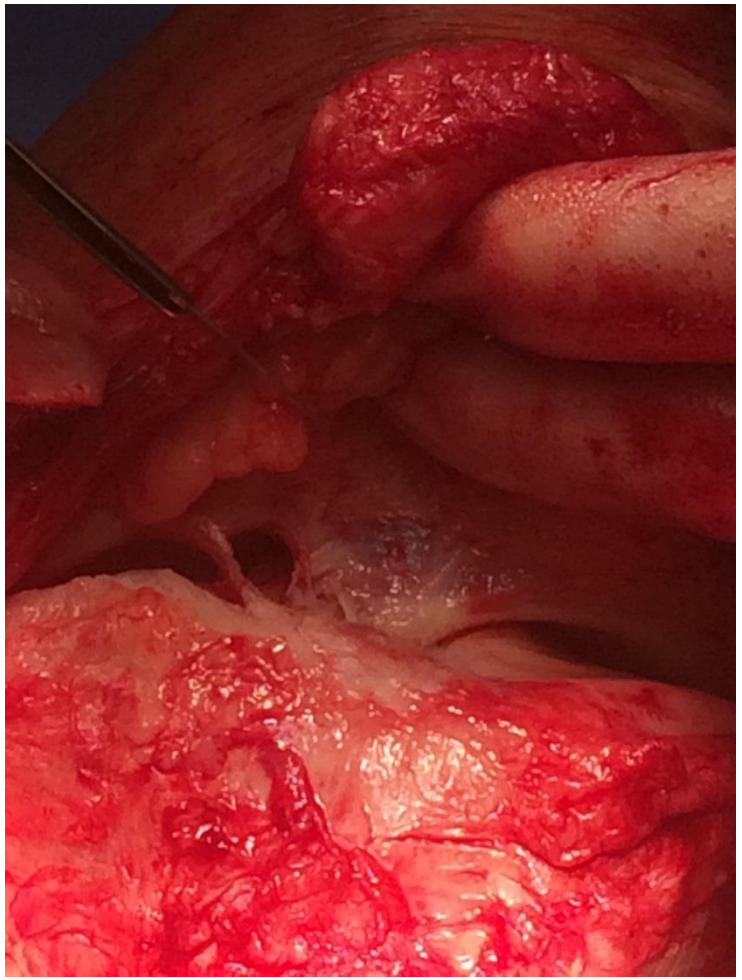

5 – Neurovascular Bundle

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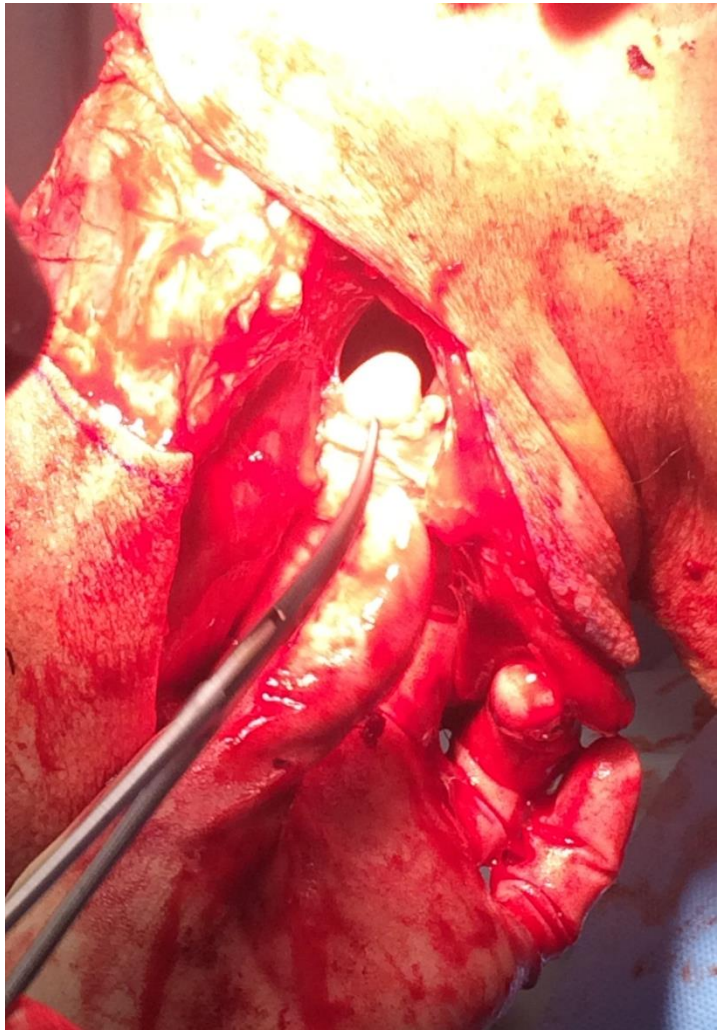

6 – Division of Cruciates

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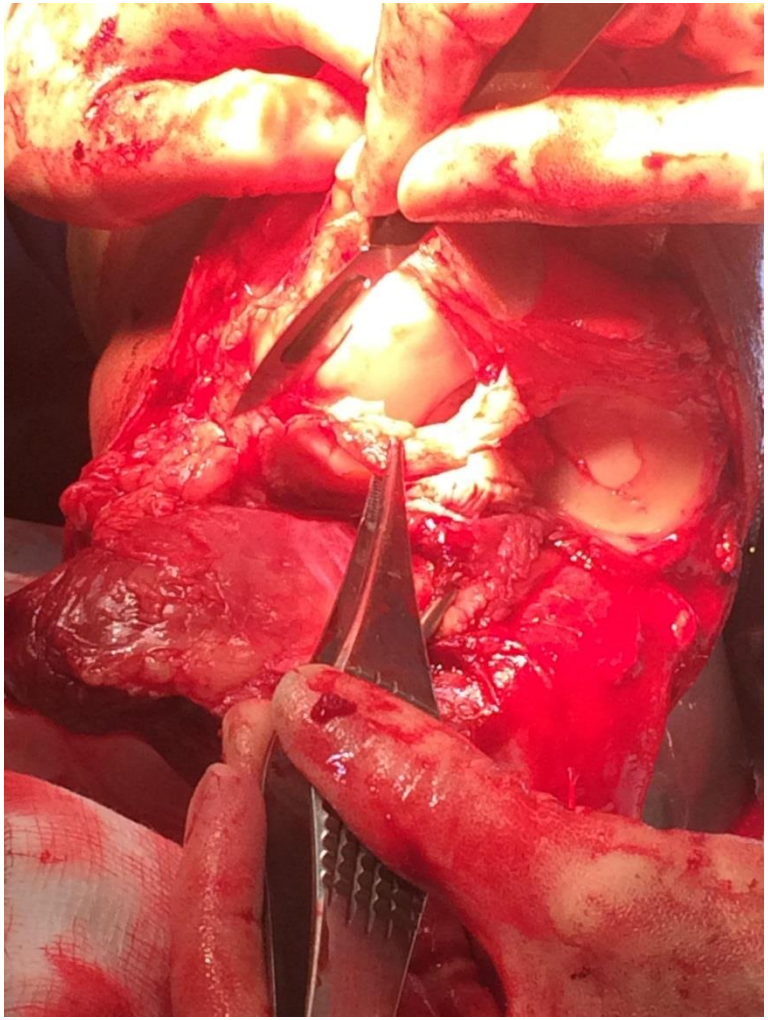
7 – Limb Amputation

8 – Preparation of Cruciates



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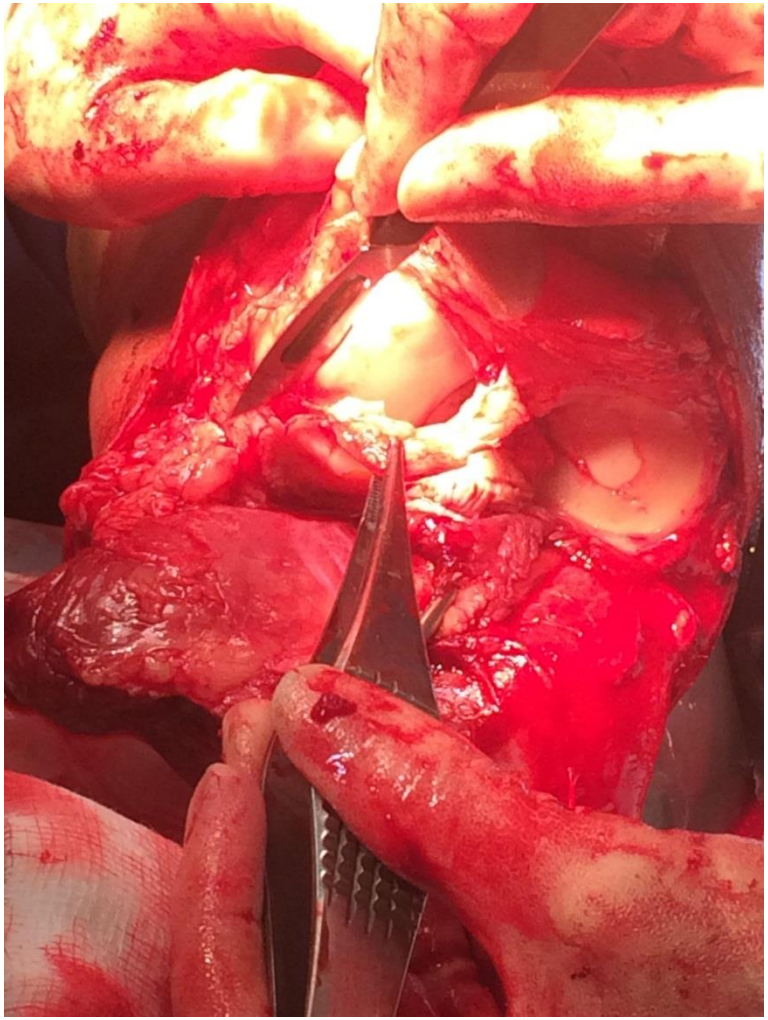
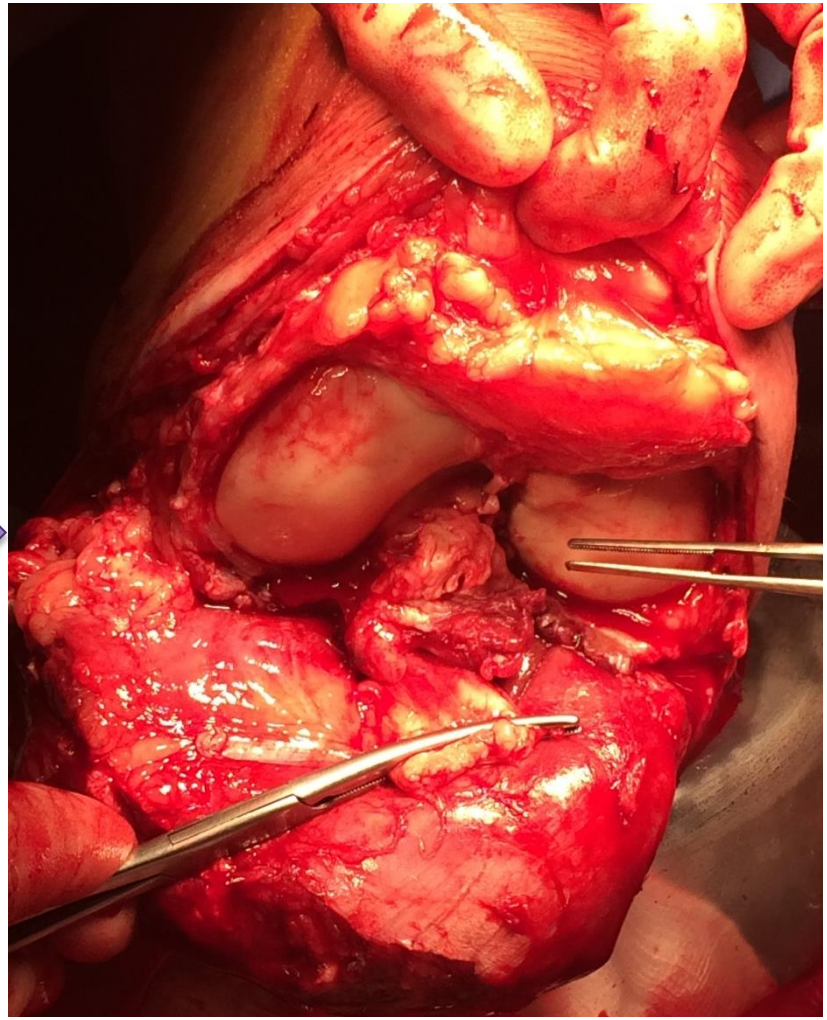
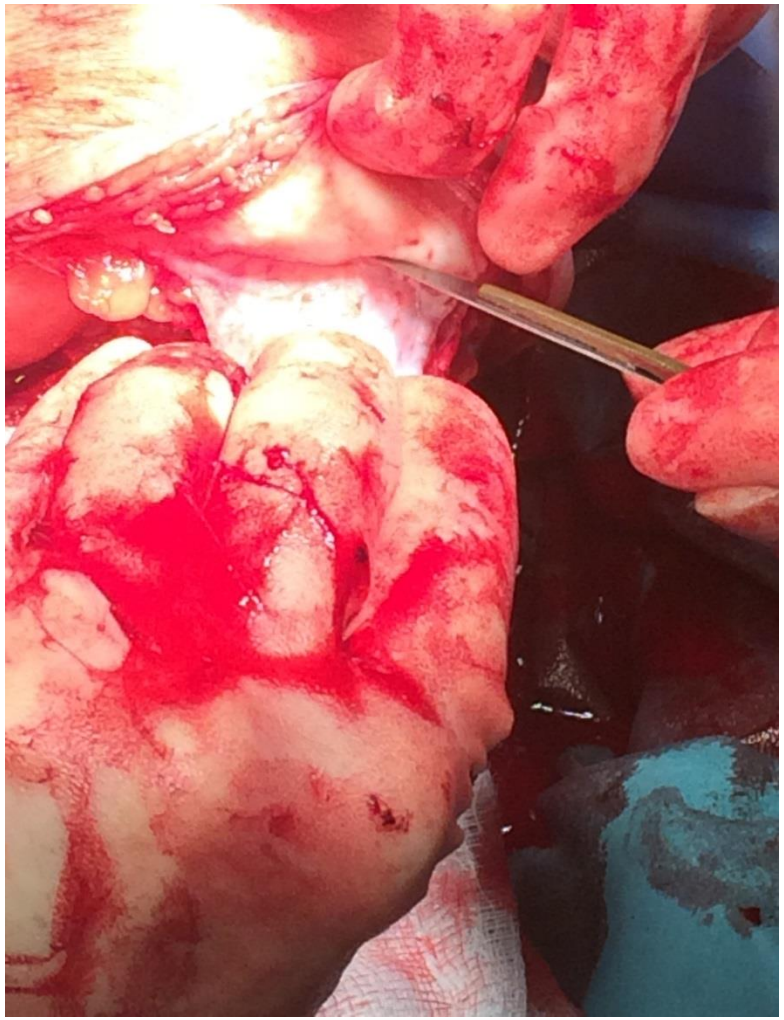




9 – Preparation of Patellar Tendon



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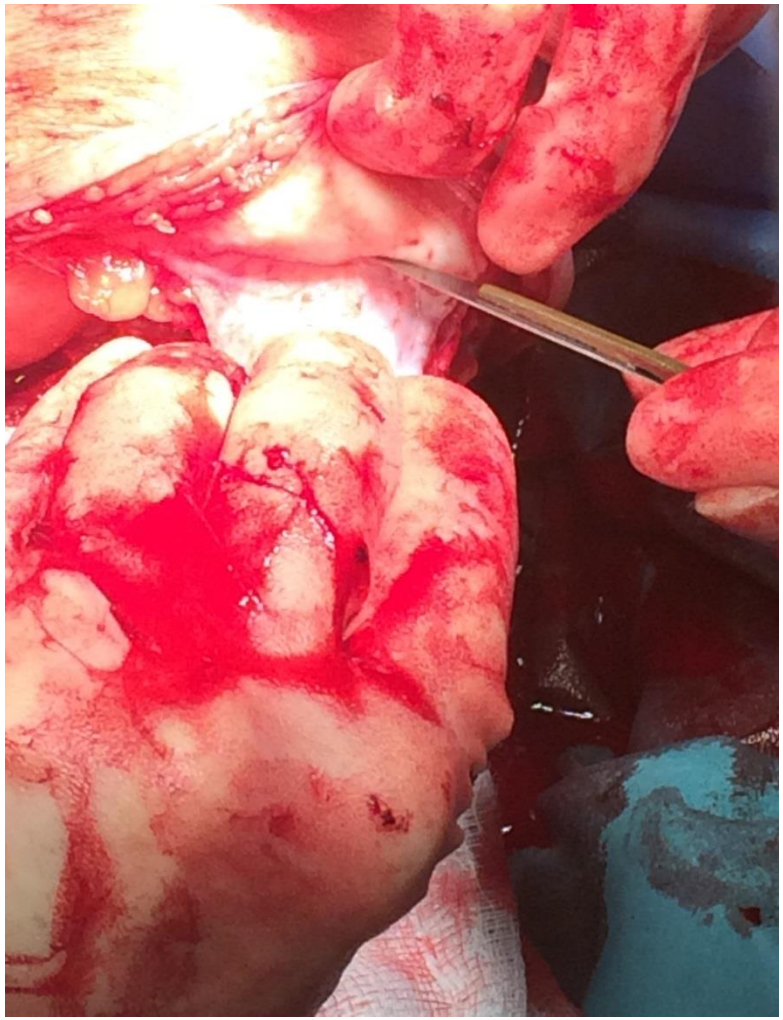
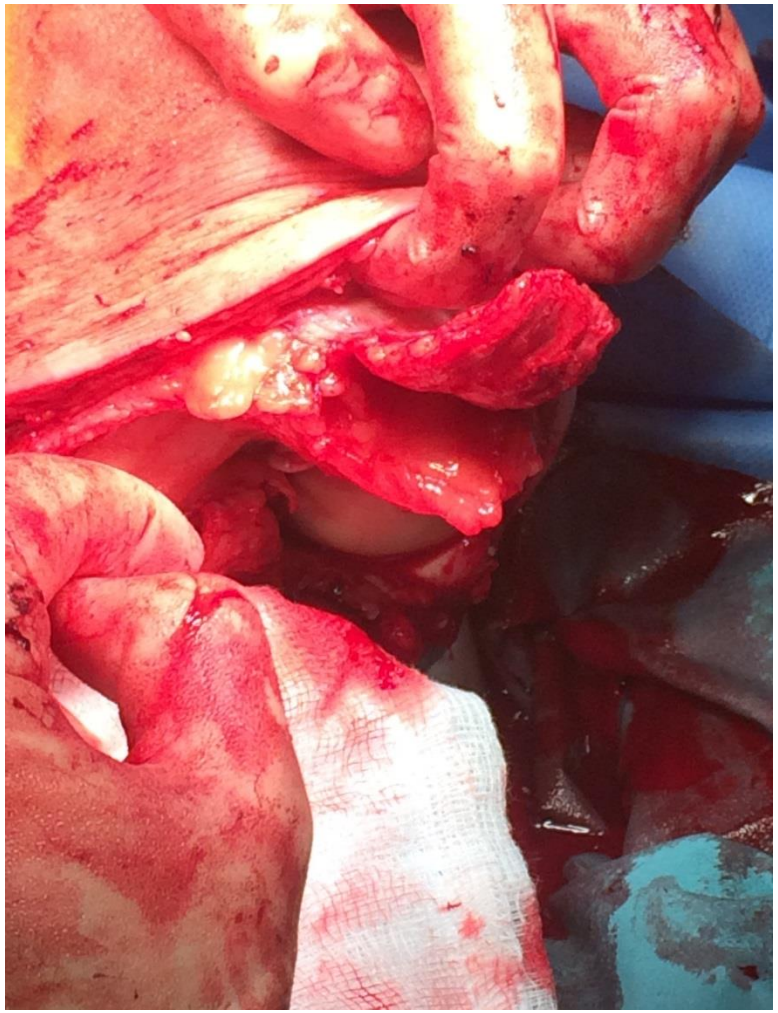
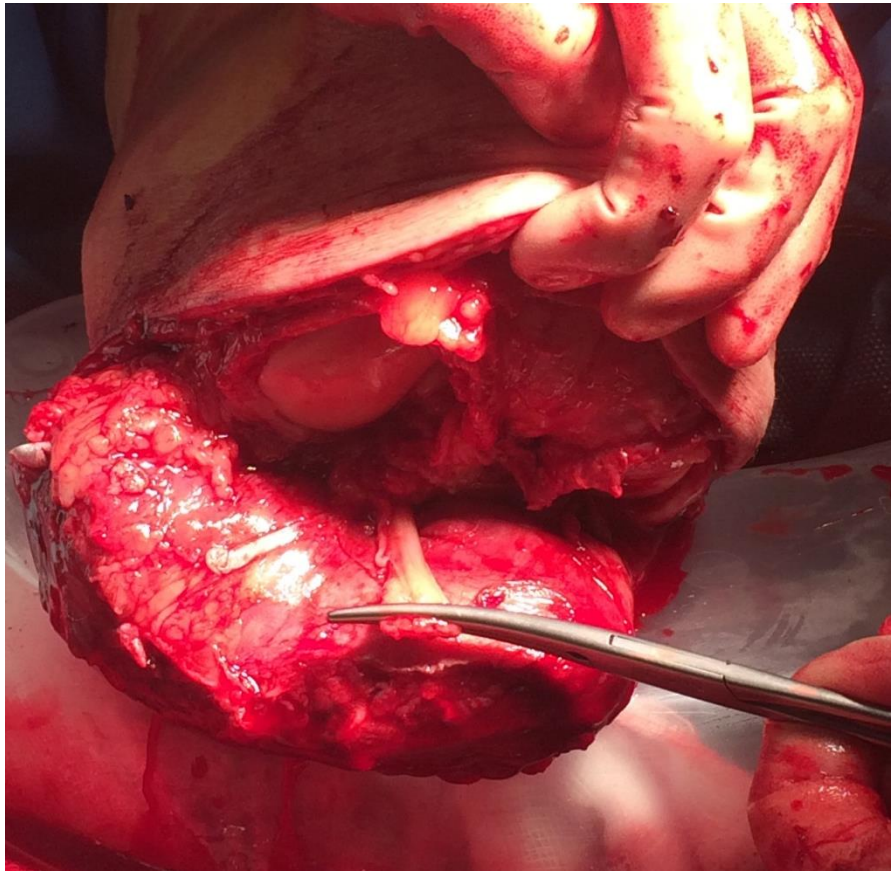




10 – Suturing of Patellar Tendon to Cruciate



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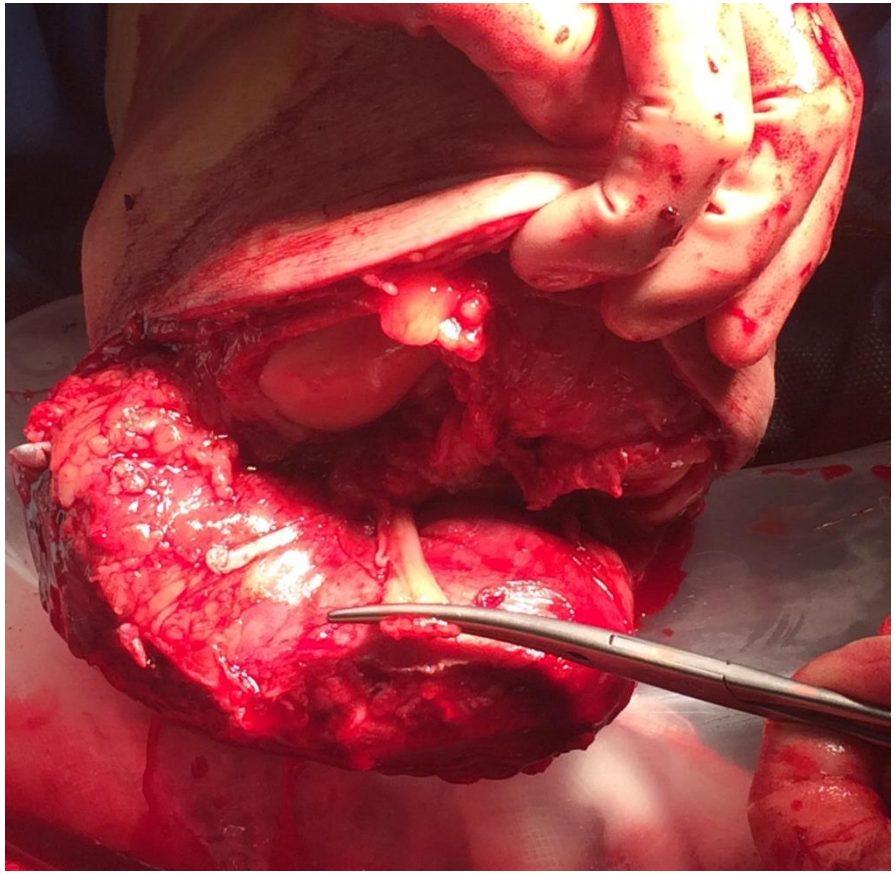

11 – Fascial Layer Closure

12 – Skin Closure

Completion

Tips and Tricks

- Pre-Operative Marking.
- Utilisation of Skew Flap Technique.
- Copious Betadine Lavage.
- Fastidious care of Fascial Layer.
- Perineural Infiltration Catheter.
- Subcuticular Closure – *Avoid Staples* and if concerned interrupted non-absorbent sutures.

How are we doing at ELHT ???

ELHT Amputation Annual Case Load

	ELECTIVE	EMERGENCY
2011	64	74
2012	84	57
2013	80	67
2014	83	57
2015	90	76
2016	90	56

ELHT Procedural Specific Case Volume

	Procedural Volume
Above Knee	163
Through Knee	3
Below Knee	136
Transmetatarsal	87
Great Toe	63
Other Toes	156

National Vascular Registry - MOD

Amputation Procedure

Record Status	Number of Records
All records	58
Submitted records	55
Submitted records with discharge date	55

Time Period: Start: 01/01/2012 End (based on discharge date): 08/02/2017 Run

Activity

Procedure Type	Elective	Non-Elective
Above/Thru knee amputation	5	15
Below knee amputation	3	7
Foot amputation	1	6
Toe(s) amputation	4	14
All	13	42

National Vascular Registry - MOD

Demographics

Variable	All Cases	Cases with Patient Data	Average Age	% Male	% Diabetes
Above/Thru knee amputation	20	20	73.29	75	30
Below knee amputation	10	10	62.54	40	90
Foot amputation	7	7	64.54	100	86
Toe(s) amputation	18	18	73.31	89	89
All	55	55	70.23	76	67

Outcomes

Variable	All Cases	Cases with Outcome Data	Return to theatre	Median LOS	% Referred to rehab/limb fitting *	In Hospital Deaths	Crude Mortality Rate
Above/Thru knee amputation	20	20	0	23	90	2	0.1
Below knee amputation	10	10	0	26	80	2	0.2
Foot amputation	7	7	4	39	100	0	0
Toe(s) amputation	18	18	1	22	44.44	6	0.33
All	55	55	5	25	74.55	10	0.18

*Referred to rehab/limb fitting uses a data item that was introduced in January 2014 and this percentage will be only accurate for tables based on procedures carried out after 01/01/2014.

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UK National Vascular Registry – 2014 to 2015

	Below knee	%	Above knee	%
Procedures	3,190		2,128	
Age group (years)				
Under 60	832	26.2	343	16.1
60 to 64	367	11.5	205	9.6
65 to 69	455	14.3	292	13.7
70 to 74	444	13.9	328	15.4
75 to 79	467	14.6	347	16.3
80 and over	622	19.5	613	28.8
Men	2,367	74.2	1,458	68.5
Women	823	25.8	670	31.5
Smoking				
Current	833	26.2	721	34.0
Ex-	1,548	48.6	1,056	49.8
Never	802	25.2	345	16.3
Presenting problem				
Acute limb ischaemia	313	9.8	481	22.6
Chronic limb ischaemia	596	18.7	481	22.6
Neuropathy	64	2.0	19	0.9
Tissue loss	1,271	39.9	754	35.5
Uncontrolled infection	933	29.3	368	17.3
Aneurysm	50	0.2	24	1.1
Previous ipsilateral limb procedure	2,001	62.8	1,311	61.7

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UK National Vascular Registry – Co-Morbidities

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ASA grade				
1 Normal	18	0.6	6	0.3
2 Mild disease	404	12.7	133	6.3
3 Severe, not life-threatening	2,222	69.7	1,293	60.8
4-5 Severe, life-threatening, or moribund patient	544	17.0	695	32.7
Comorbidities				
None	263	8.2	210	9.9
Hypertension	1,904	59.7	1,324	62.2
Ischaemic heart disease	1,201	37.7	908	42.7
Diabetes	2,157	67.6	873	41.0
Stroke	297	9.3	322	15.1
Chronic lung disease	444	13.9	551	25.9
Chronic renal disease	709	22.2	398	18.7
Chronic heart failure	268	8.4	230	10.8
Medication				
None	299	9.4	220	10.3
Anti-platelet	2,292	71.9	1,538	72.3
Statin	2,319	72.7	1,496	70.3
Beta blocker	836	26.2	564	26.5
ACE inhibitor/ARB	1,086	34.0	672	31.6

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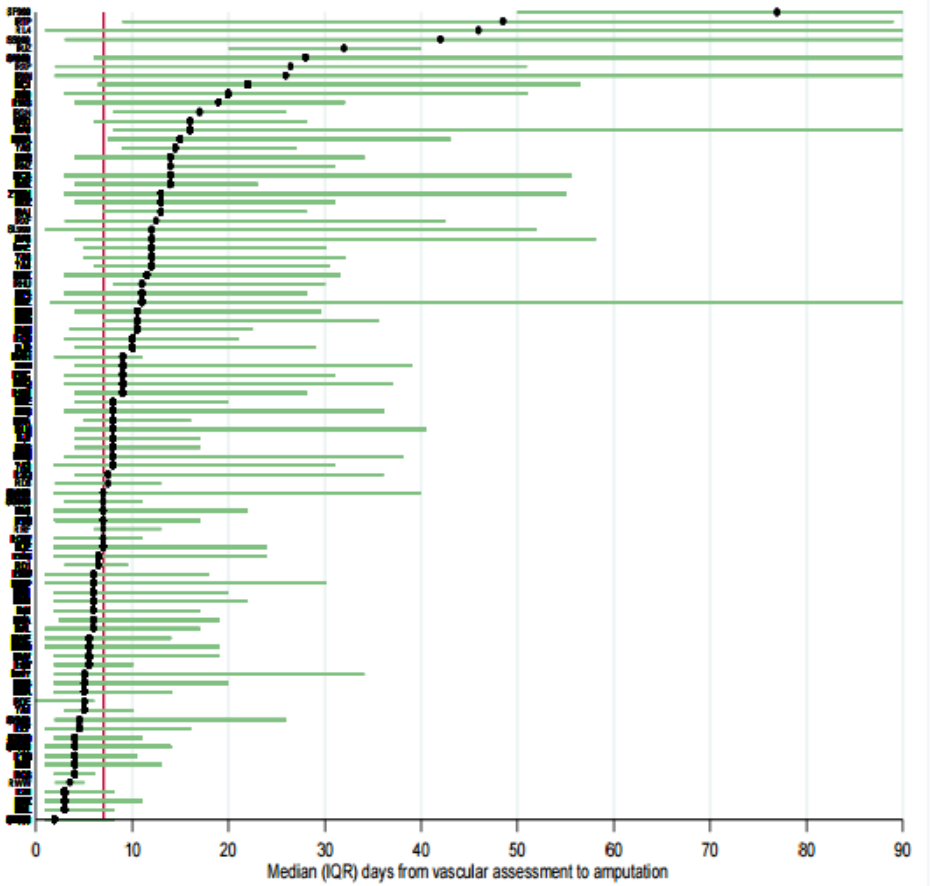

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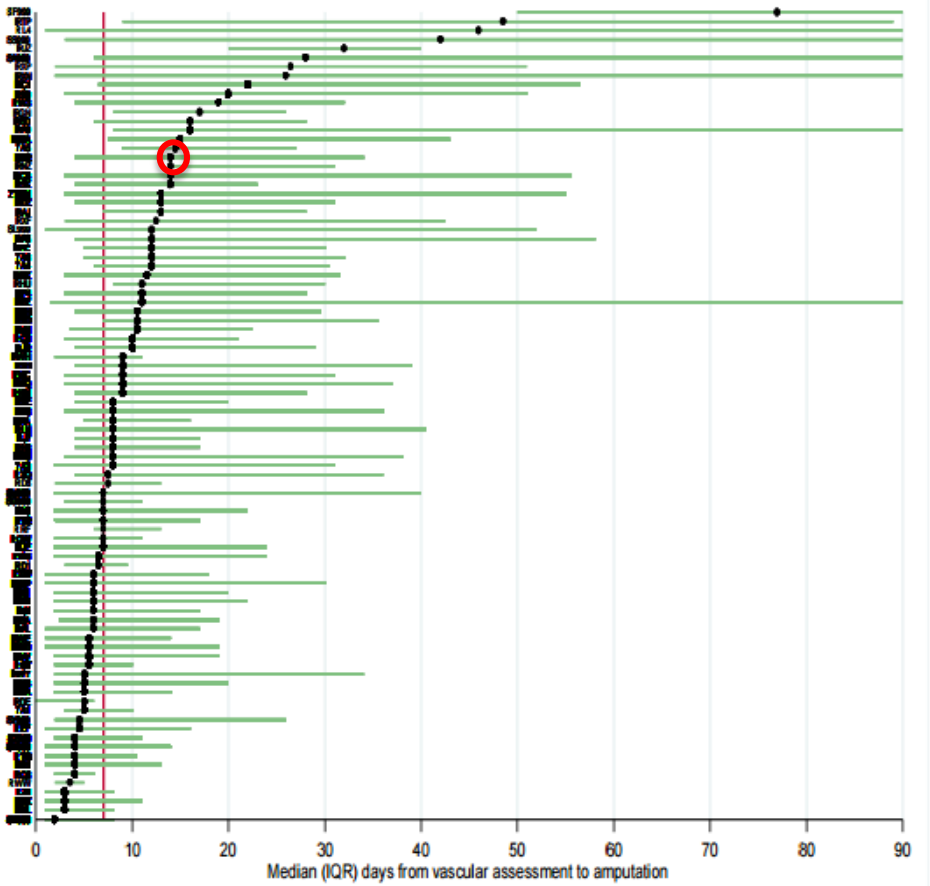
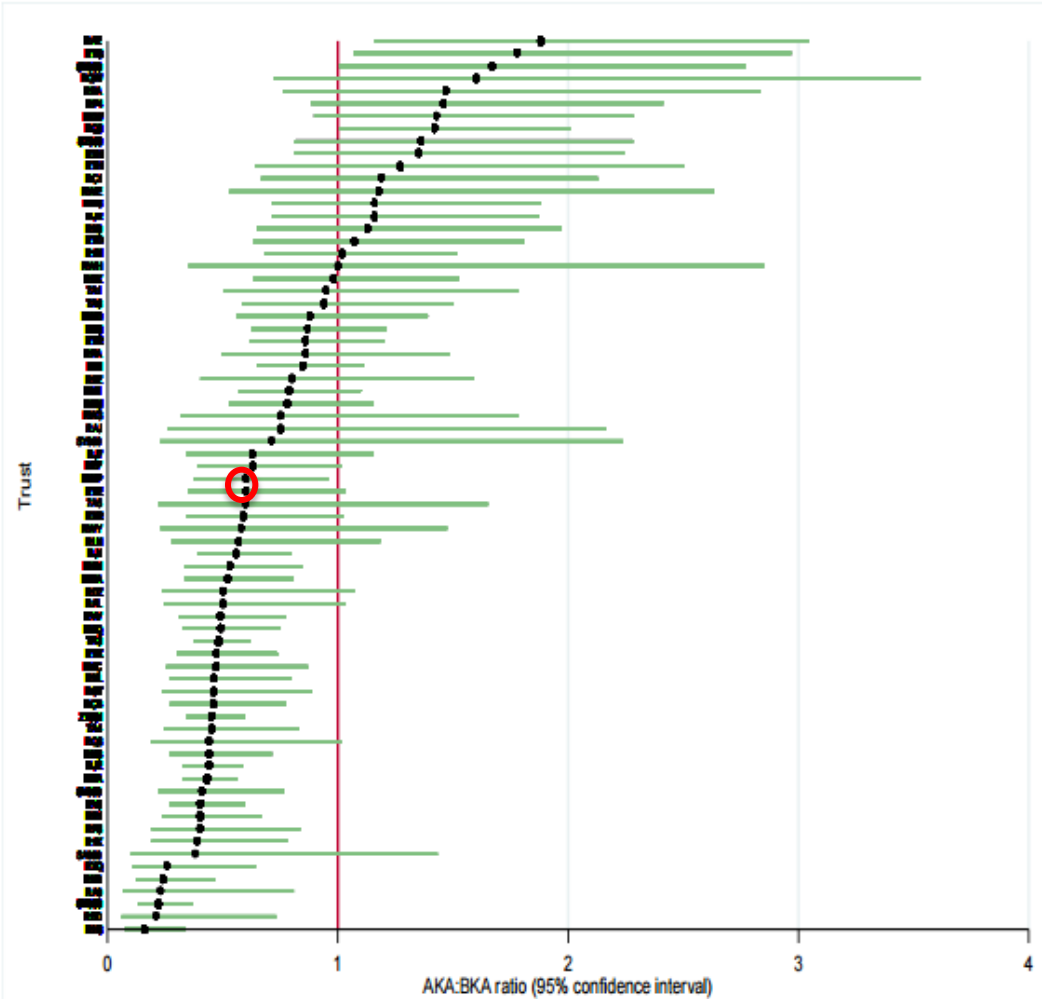
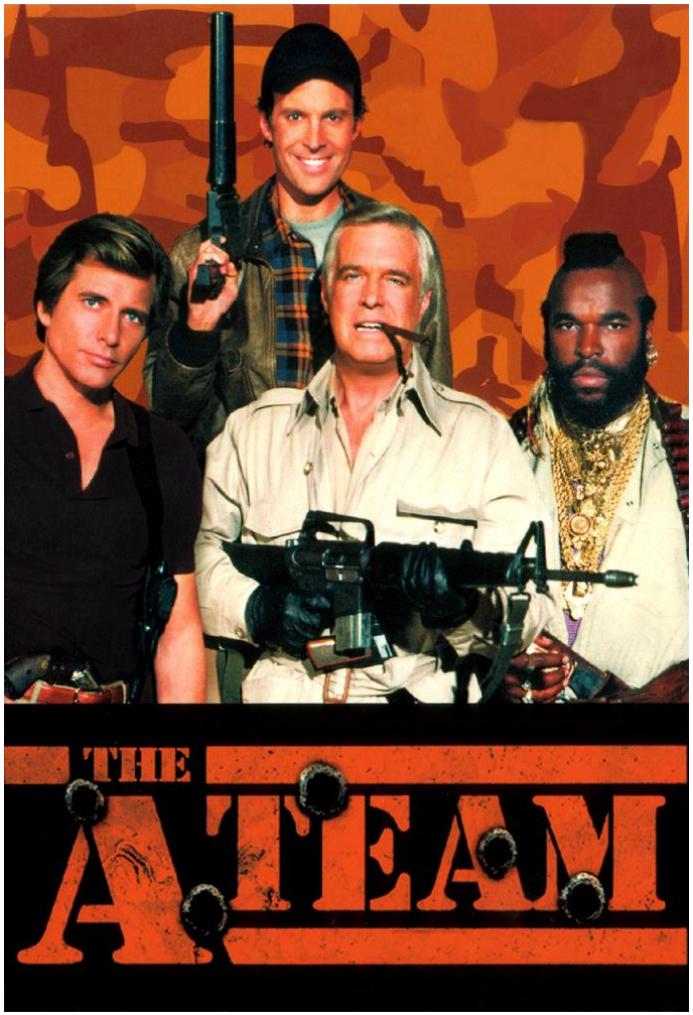


UK National Vascular Registry – AKA: BKA Ratio



Future Care – LASER Team



LASER Team Conception

- Multidisciplinary Team Approach.
  - Specialised Vascular Services, NHS England 2014.
- Specialised Care Providers **with Passion**.
- Recognition of Patient Flow.
- Open Communication.
- Ability to influence management quickly.

LASER Team Recruitment

- Senior Podiatry Staff; Gill Lomax, Carl Kenright and Peter Reston.

Belfast Health and Social Care Trust
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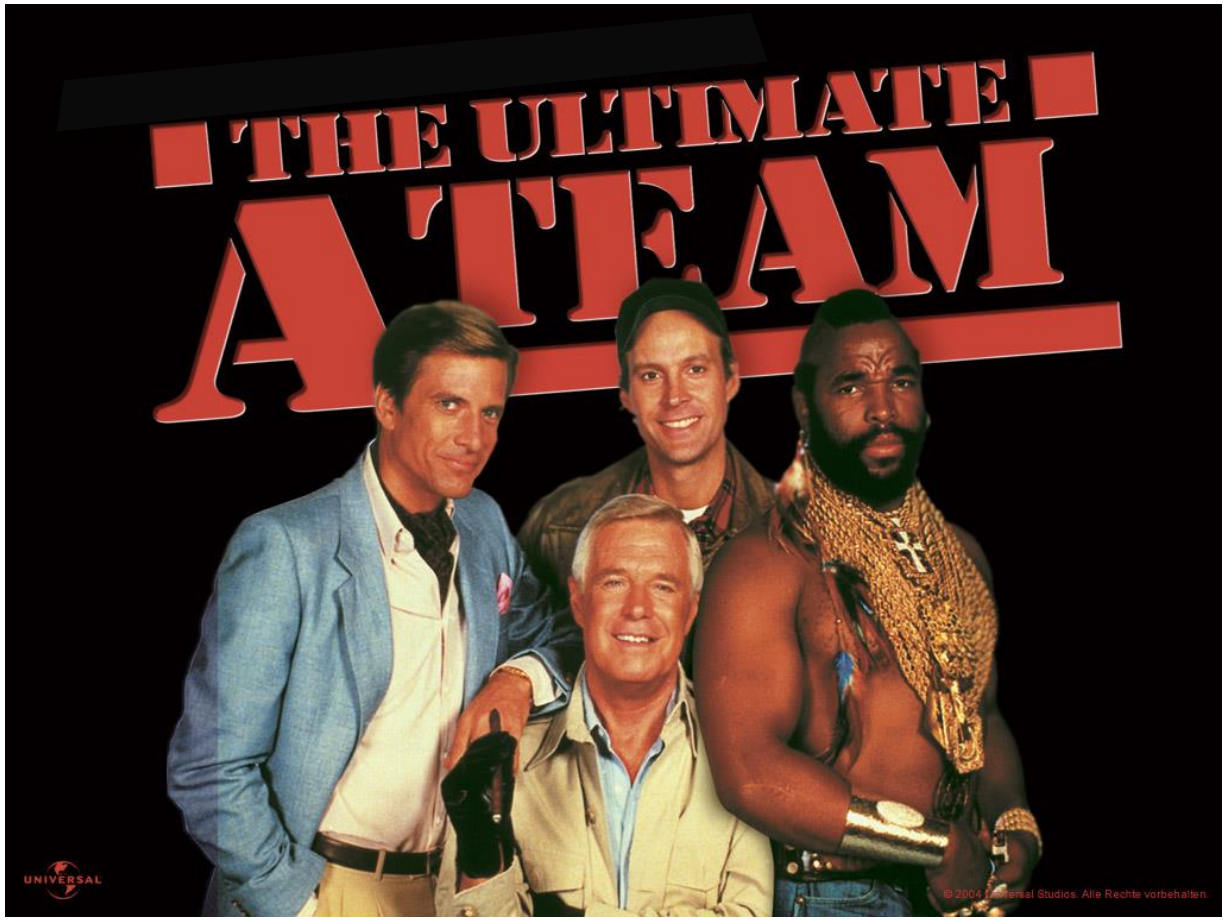
- Vascular Surgeon with an Interest in Limb Salvage; Mr Mark O'Donnell.
- Microbiologist; Dr Ruth White.

LASER Team Evolution

- Training / Education;
  - Orthopaedic Specialist Nurses.
  - Endocrinology Trainees.
  - Medical Trainees.
  - Vascular Surgery Trainees.
  - Nursing staff education.


THE ULTIMATE
A-TEAM
UNIVERSAL
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What do we actually do???

- Patient Identification.
- Prioritisation Logistics.
- Clinical Review at Bedside – NOT AROUND A DESK.
- Expedited Care Management.
- Expert Review.

What do we actually do???

- Patient Identification;
  - Point of contact referral from podiatry / specialist nurse / vascular laboratory.
  - Real-time email correspondence.
  - Ward referral.

What do we actually do???

- Patient Identification.

- Prioritisation Logistics;
  - Most at risk patients.
  - LASER round ward attendance flow.

What do we actually do???

- Patient Identification.
- Prioritisation Logistics.

- Clinical Review;
  - Limb exposure.
  - Diabetic medical review and optimisation of co-morbidities.
  - Orthopaedic clinical and radiological evaluation.
  - Vascular assessment including bedside Doppler.

What do we actually do???

- Patient Identification.
- Prioritisation Logistics.
- Clinical Review.

- Expedited Care Management;
  - Bedside dressing optimisation / wound debridement / offloading.
  - Microbiological sampling – tissue and bone.
  - Pharmacological optimisation.
  - Same day vascular laboratory evaluation.
  - Radiological / surgical intervention within 24 hours.

- Expert Review.

What do we actually do???

- Patient Identification.
- Prioritisation Logistics.
- Clinical Review.
- Expedited Care Management.

- Expert Review;
  - Email summary of decision processes.
  - Vascular MDT discussion.
  - Diabetic / orthopaedic pathway.
  - Diabetic / vascular pathway.
  - Cross-over frequent.

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Review of LASER Practice

Patient Demographics and Co-Morbidities

- 127 patients had 198 assessments performed between October 2015 and March 2017;
  - Male=99, Female=28.
  - Mean age 69 (range 36-102) years.
  - Mean LASER assessments 2.25 (range 1 – 5).

- Patient co-morbidities included;
  - Diabetes 93.4% (n=185).
  - Hypertension 56.1% (n=111).
  - Hypercholesterolaemia 22.2% (n=44).
  - Smoking 14.1% (n=28).

Investigations

- Mean haematological indices included;
  - Haemoglobin 10.9g/L.
  - White cell count 10.8 x10^9/L.
  - Creatinine 122 µmol/L.
  - C-reactive protein 77.5mg/L.

- All patients had a bed-side doppler assessment.

- Formal vascular laboratory testing was completed in 148 assessments (74.7%) with a mean ankle brachial index of 0.59 in the affected limb.

- 26 patients had osteomyelitis diagnosed via Xray with an additional 3 confirmed via MRI (22.8%)

Treatment

- Medical;
  - All Kardex's were reviewed.
  - Best medical therapy commenced as required.
  - Antibiotic therapy reviewed and rationalised.

Treatment

- A total of 48 revascularisations were performed;
  - Endovascular=39.
  - Surgical endarterectomy / arterial bypass=3.
  - Combined endovascular / surgical=6.

- Wound Care / Amputation;
  - Seven patients had wound debridement alone.
  - Fifty toe amputations.
  - Twelve major limb amputations.
  - Four patients refused treatment.

Patient Outcome

- 37 (29.1%) patients died throughout the study.
- 24 (18.9%) patients were re-operated on, of which 9 (37.5%) had amputation revision to higher level

LASER Service Conclusions

- Our initial experience has identified an extremely high-risk patient population presenting with advanced diabetic ischaemia pathology.

- A combined multi-disciplinary approach afforded rapid investigation and subsequent therapeutic intervention in 59% of total assessments, suggesting a labour intensive approach is required to limit limb loss and mortality, which still remains high in this patient population.

Future Aspirations for LASER Team

- Business Plan.
- Increased frequency of service.
- Education.
- Out-patient / Community expansion.

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- Business Plan.
- Increased frequency.
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Fewer Amputations.

Questions ?