



**50th
Anniversary
Meeting**

9-10th May 2024

National Army Museum, London

CSOS Founding Members

Mr J Crawford Adams
Surgeon Captain J Bertram
Lieutenant Commander A Boyd
Mr Donal Brooks
Mr H Jackson Burrows (Founding President)
Surgeon Commander A Chakraverty
Professor J Ellis
Surgeon Captain PC Fulford
Air Commandore CR Griffin
Surgeon Captain BV Jones
Mr G Lloyd-Roberts
Group Captain RW Povey
Lieutenant Colonel GI Small
Mr D St.C Strange
Surgeon Commander RC Telfer
Wing Commander HJ Vieyra

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Agenda Day 1

9th May 2024



- 0830 - 0855 Registration and coffee
- 0900 - 0910 Welcome and Administration
Colonel Alistair Mountain L/RAMC DCA T&O
- 0920 **Best of the Best - Trainee Presentations.**
Moderators: Lieutenant Colonel Kate Brown RAMC and Lieutenant Colonel (Retd) James Singleton RAMC
(all presentations 6 minutes followed by 3 minutes of questions)
- 0920 - 0929 10 years on: A Review of UK Military Personnel living with Upper Limb Amputation.
Surgeon Lieutenant Commander Liam Kilbane RN
- 0930 - 0939 Ten Years of Direct Skeletal Fixation for Military Veterans: An overview of Outcomes
Major Charles Handford RAMC
- 0940 - 0949 A Field Evaluation of proprietary and improvised pelvic binders for use in the pre-hospital environment.
Captain Thomas Howe RAMC
- 0950 - 0959 Preventing Complications of deep infection in complex hosts: using DAC with bone and joint surgery.
Captain Helen Smith RAMC
- 1000 - 1009 Human Augmentation in the Military Musculoskeletal Context - Current Concepts and Review of the Literature
Major Kirsty Milne RAMC
- 1010 - 1019 Abdominal Aortic Junctional Tourniquets - Clinically Important Increases in Pressure in Aortic Zone 1 and Zone 3 in a Cadaveric Study directly relevant to Combat medics treating non-compressible torso haemorrhage.
Captain Thomas Smith RAMC

Agenda Day 1

9th May 2024



- 1020 - 1030 Gold Sponsor Presentation - The Royal College of Surgeons of Edinburgh
- 1030 - 1100 Coffee break, Industry Quiz and Trade Fair
- 1100 **Rapid Fire Session- Trainee Presentations.**
Moderators: Lieutenant Colonel Neil Eisenstein RAMC and Wing Commander Edward Spurrier RAF
(all presentations 3 mins with 10 min for questions at end of session)
- 1100-1125 **Session 1**
External Fixators in Austere Environments under Surge Capacity Conditions: A Systematic Review
Dr David Bull
- A closed loop audit looking at open fracture management at a JHG
Surgeon Lieutenant Daniel Mills RN
- Keeping it clean – challenges facing surgical sterilisation in the modern era
Major Henry Chandler RAMC
- Orthopaedic Burden in Disaster
Major Josh McIntyre RAMC
- Pilot study of a Low-Cost, Light-Weight, 3D-Printed External Fixator for Trauma in Resource Limited Settings
Major Kyung-Hoon Moon RAMC
- 1125-1150 **Session 2**
Whole body vibrations and lower back pain: A systematic review of current literature
Major Abigail Bainbridge RAMC
- Risk Stratification Scoring System for Proximal Femur Bony Stress Injuries in Military Recruits
Surgeon Lieutenant Ben Atkin RN

Agenda Day 1

9th May 2024



X-ray templating in hemiarthroplasty – Is it a load of balls?
Major Helen Smith RAMC

An audit of orthopaedic waiting times in two DPHC medical centres and its consequences on medical discharges from the British Army
Captain James Kirkpatrick RAMC and Captain Glen Wilson RAMC

Emergency Arthroplasty, the expanding epidemic of periarticular and periprosthetic fractures at a large Trauma Unit. The BUCKs Health Experience
Surgeon Lieutenant Commander Richard Myatt RN

1150-1215

Session 3

Outcomes and Predictors of Non-Union in Midfoot Arthrodesis
Mr Angus Reynolds

Childcare Provision for On-Call Workers in the NHS: Is the 24/7 Service Ideal Matched by Reality?
Flight Lieutenant David Cain RAF

Orthopaedic theatre radiation protection provision: Is it adequate?
Surgeon Lieutenant Commander Louise McMenemy RN

Effect of a perpendicular reference point on a surgeon's angle estimation as demonstrated by the effect of hip rotation on operative femoral anteversion.
Squadron Leader Pramir Raut RAF

Evaluation of Accuracy and Efficiency of Smart Taylor Spatial Frames in Deformity Planning: A Comparative Study
Major Timothy Packer RAMC

1215-1225

Gold Sponsor Presentation - LEDA

Agenda Day 1

9th May 2024



- 1225 - 1400 **Lunch, Industry quiz and Trade Fair**
- 1225 - 1300 AGM (for members of the society)
- 1400 – 1415 **Prize giving**
The Peter Templeton Prize (Best trainee paper)
The Philip Fulford Prize (Best quick fire)
The Mike McErlain Travelling Fellowship Award
- 1415-1700 **Afternoon Session: Preparation for consultancy**
- 1415-1445 Financial Planning
Mr Edward 'Ted' Wilson, Wilson Wealth Advisory
- 1445-1505 How to get a consultant post and job planning
Colonel Alistair Mountain L/RAMC DCA T&O
- 1505-1520 Life as a Year One consultant
Lieutenant Colonel Charlotte Tunstall RAMC
- 1520-1610 **Coffee break, Industry Quiz and Trade Fair**
- 1610 – 1620 Gold Sponsor Presentation - United Risk Partners
- 1620-1700 Medico-legal aspects of social media
Mr William Childs, Weightmans LLP
- 1700 Closing remarks
Colonel Alistair Mountain L/RAMC DCA T&O
- 1900 **Evening entertainment**

Agenda Day 2

10th May 2024



- 0830 - 0855 Registration and coffee
- 0900 - 0910 Welcome
Colonel Alistair Mountain L/RAMC DCA T&O
- Morning Session - CSOS through the years**
- 0910 - 0950 CSOS at 50 years: The Evolution of a Specialist Society
Colonel (Retd) Mike Stewart CBE L/RAMC
- 0950 - 1010 The Balkan Saga
Colonel Paul Parker L/RAMC
- 1010 - 1030 Op Telic and Herrick
Colonel (Retd) David Standley L/RAMC
- 1030 - 1040 Platinum Sponsor Presentation - Wilson Wealth Advisory
- 1040 - 1115 **Coffee break, Industry Quiz and Trade Fair**
- 1115 - 1125 Platinum Sponsor Presentation - Stryker
- 1125 - 1145 The Role 4 experience
Group Captain Ian Sargeant OBE RAF
- 1145 - 1210 The Ukrainian Experience
Colonel Dmytro Los (UAF)
- 1210 - 1220 Platinum Sponsor Presentation - Orthofix
- 1220 - 1400 **Group Photograph, Lunch, Industry Quiz and Trade Fair**

Agenda Day 2

10th May 2024



1400 – 1410 Platinum Sponsor Presentation - Arthrex

Afternoon Session 1 – A Life Less Ordinary

1410 – 1430 UK Veterans Care
Lieutenant Colonel Carl Meyer RAMC

1430 – 1450 UK-Med
Surgeon Commander Steve Mannion RNR

1450 – 1510 Iquarus
Group Captain (Retd) Jonathan Kendrew RAF

1510 – 1540 **Coffee break, Industry Quiz and Trade Fair**

1540-1550 Platinum Sponsor Presentation - Paragon 28

Afternoon Session 2 – Defence Musculoskeletal Academia

1550 – 1610 History of military orthopaedic research
Colonel (Retd) Jon Clasper CBE L/RAMC

1610 – 1630 Rehabilitation research and ADVANCE
Group Captain Alex Bennett RAF

1630 – 1640 The Future of Defence Orthopaedic Academia
Colonel Arul Ramasamy L/RAMC

1640-1700 Announcement of Quiz winner and State of the Union Address
Colonel Alistair Mountain L/RAMC DCA T&O

1700 Close of meeting

Welcome from the President



As the current President of the Combined Services Orthopaedic Society, it is my pleasure and privilege to welcome you to this 50th anniversary meeting of the CSOS at the National Army Museum in Chelsea.

Fifty years ago, a group of enlightened individuals, came to together to form the Society. The aim, as I was told as a Naval trainee, was to share information on a tri-service basis and to allow trainees to present work in a constructive environment, as so often the environment at meetings was the exact opposite! There was an element of a silo mentality in those days and the CSOS was in part created to break that mould.

All but one of those men have passed on, but Surgeon Captain John Bertram is still going, and our thanks go to him and his colleagues for the vision to create this society. My first experience was in 1992 at the then Royal Naval College in Greenwich, working for another of our recently departed colleagues, Dougie Sommerville.

Times have changed enormously for all of us since those days and the Society is no exception. It is with a profound sense of pride that I look at the diversity of today's Society and listen to the outstanding achievements and work that successive generations of trainees and consultants have done both in the laboratory and the field of combat.

As we reach our half century the local organising committee have put together an excellent extended two day meeting, once again highlighting the current research and clinical work by members of the Defence Medial Services but also reflecting on the past events and achievements by members of the Society.

I hope you will all find the next two days enlightening and enjoyable in equal amounts and if you have a moment, spare a thought for those original members who started it all; fifty years ago.

Mr Simon Hodkinson

Consultant in Trauma and Orthopaedic Surgery
President, Combined Services Orthopaedic Society



Welcome from the Chairman



On behalf of the Local Organising Committee for CSOS24, I am delighted to welcome you all to the 50th Anniversary Meeting of the Combined Services Orthopaedic Society.

We are honoured to be hosted at the National Army Museum in Chelsea for both days of the meeting and to have the dinner on Friday at the Royal Hospital Chelsea.

The Local Organising Committee have crafted a programme that is both reflective and progressive, combining the past whilst looking forward to the next challenges. The format of the meeting has therefore changed slightly in that it is being delivered over two days where historically the Thursday session was devoted to the instructional CSOS (iCSOS) allowing updates specific to trainees. The Friday was then the formal academic meeting.

Colonel Ramasamy, in his role of Defence Professor, is keen to allow enough time in the programme during this year's meeting for members to spend catching up with colleagues in between the sessions. The Thursday will have the trainee's academic presentations and also have a session concentrating on the early years of consultant practice.

The Friday will be different in that the society will reflect on previous campaigns and also have an up to date reflection on current conflicts. The society is a civilian society and the session "a life less ordinary" will explore the opportunities outside of military service. Finally there will be an update on research priorities for the future.

I would urge you all to spend time with colleagues and the representatives from the orthopaedic industry and associated sponsors as without their time and support, we would not have been able to contemplate such an ambitious meeting.

Colonel Alistair Mountain L/RAMC
Defence Consultant Advisor, Trauma and Orthopaedics
Chairman, Combined Services Orthopaedic Society



CSOS 50th Meeting Local Organising Committee



Col A Ramasamy L/RAMC



Col A Mountain L/RAMC



Lt Col (Retd) D Edwards RAMC



Lt Col T Pearkes RAMC



Maj S Stewart RAMC



Sqn Ldr P Raut RAF



Maj H Claireaux RAMC



Surg Lt Cdr S Lakhani RN



Capt T Howe RAMC

History of CSOS



The Combined Services Orthopaedic Society was formed in 1974 in order to promote orthopaedic specialty training in the Armed Services as a civilian organisation. It is funded entirely by the member's contributions and sponsorship from trade organisations. Meetings are held annually, and are open to all present and past members of the Armed Services with an interest in Trauma and Orthopaedics. In addition Consultant Advisor's to the Defence Medical Services are invited.

The change in Military Secondary Care Medical Provision in the last few years, with the formation of the Ministry of Defence Hospital Units within large NHS Trusts and military trainees being placed into centres of excellence, has provided a platform for trainees to present work on a broad range of Orthopaedic subjects.

More recently, the conflicts in Iraq and Afghanistan have increased the relevance of Military Trauma and thus the overall reputation of the Society. As an affiliated Society to the British Orthopaedic Association, the annual meeting now has a recognised position in the Orthopaedic Events Calendar.





History of the venues

National Army Museum

The National Army Museum is a leading authority on the British Army and its impact on society past and present. It examines the Army's role from the British Civil Wars to the modern day and through its collections hopes to preserve and share stories of ordinary people with extraordinary responsibilities.

Its remit for the overall history of British land forces contrasts with those of other military museums in the United Kingdom concentrating on the history of individual corps and regiments of the British Army. It covers the pre-independence history of the East India Company Army, the British Indian Army and other colonial units as well as housing the regimental or corps collections of the East Kent Regiment, the Middlesex Regiment, the Women's Royal Army Corps, and the Irish regiments disbanded in 1922, part of that of the former Museum of Army Transport and the archives of the Coldstream Guards and Grenadier Guards.

The National Army Museum was first conceived in the late 1950s, and owes its existence to the persistent hard work of Field Marshal Sir Gerald Templer, who did most of the fundraising for it. It was established by Royal Charter in 1960, with the intention of collecting, preserving, and exhibiting objects and records relating to the Regular and Auxiliary forces of the British Army and of the Commonwealth, and to encourage research into their history and traditions. It was initially established in 1960 in temporary accommodation at the former No.1 Riding School at the Royal Military Academy Sandhurst.

A new purpose-built building, designed in brutalist style by William Holford & Partners, was started in 1961 on a site which had previously formed part of the old infirmary of the Royal Hospital Chelsea. The new building was completed ten years later and opened by the Queen on 11 November 1971.



History of the venues



Royal Hospital Chelsea

The story of the Royal Hospital Chelsea began over 300 years ago during the reign of King Charles II, whose vision for a home for veteran soldiers was brought to life by Sir Christopher Wren.

Until the 17th Century, the state made no specific provision for old and injured soldiers. Care for the poor and sick was provided by the religious foundations. Most of this provision ended following the dissolution of the monasteries during the reign of King Henry VIII. In 1681, responding to the need to look after these soldiers, King Charles II issued a Royal Warrant authorising the building of the Royal Hospital Chelsea to care for those 'broken by age or war'. Sir Christopher Wren was commissioned to design and erect the building.

The chosen site, set adjacent to the River Thames in the countryside of Chelsea contained the uncompleted building of the former 'Chelsey College'. In 1692 work was finally completed and the first Chelsea Pensioners were admitted in February 1692 and by the end of March the full complement of 476 were in residence.

The residents of the Royal Hospital, known the world over as Chelsea Pensioners, have all served as ordinary soldiers in the Armed Forces at some point in their lives, and now, in their later years, find a warm welcome amidst the camaraderie and banter of their fellow veterans.



ABSTRACTS

Best of the Best



10 Years On: A Review Of UK Military Personnel Living With Upper Limb Amputation.

Surg Lt Cdr Liam Kilbane, Mr Darren Roberts, Surg Capt (Retd) Sarah Stapley RN

Presenting author:

Surgeon Lieutenant Commander Liam Kilbane RN
ST6

Aims: Assess how personnel with hand and arm amputations have progressed with working life, function and daily activities.

Methods:

1067 UK military personnel sustained upper limb (UL) injuries resulting from conflicts in the Middle East between 2004-2014. 32 major UL injuries with 22 having associated lower limb amputations. 46 sustained partial hand amputations. Interviews were completed using a questionnaire, Quick DASH and EQ5D scores.

Results:

33 participants. Median age at injury 23, and 37 at interview. Injury to discharge averaged 4 years. 70% returned to some form of employment. 12% still reported symptomatic phantom limb pain. Those utilising UL prosthetic did so for specific purposes. Time from injury to UL prosthetic fitting was an indicator of continued use. Mean DASH and EQ5D scores 18.4 and 75.6%.

Conclusion:

Very good outcomes achieved by military personnel following multiple, complex and life-changing injuries.



Ten Years of Direct Skeletal Fixation for Military Veterans; An Overview of Outcomes

Handford, C. Toderita, D. Hindle, P. Kendrew, J. Evriviades, D. Ramasamy, A. Bull, AJ, McMenemy, L.

Presenting Author:

Major Charles Handford RAMC
ST6

Advancements in trauma care on Operations in Iraq and Afghanistan led to 'unexpected survivors,' primarily highly motivated above-knee amputees unable to mobilise with standard prosthetics due to complex soft tissue injuries. Using LIBOR funding, 21 veterans (35 femoral residuum's) received OGAP-OPL Direct Skeletal Fixation.

Results from two patient cohorts, the first (13 patients) with surgeries averaging 7.69 (5-10) years and the second (8 patients) treated within the last 2 years following transition to an NHS Consultant led delivery model, indicate promising outcomes.

In the established cohort low explantation rates of 8% (n=1 implant) and minimal chronic suppressive antibiotic use of 15% (n=2 patients) reassure regarding complications due to uncontrolled infection.

The incidence of fractures 30% (n=4) from falls whilst ambulant suggests successful rehabilitation.

Favourable patient-reported outcomes and functional benefits, coupled with cost-effectiveness, advocate for continued research and potential NHS adoption.



A Field Evaluation of Proprietary and Improvised Pelvic Binders for Use in the Pre-hospital Environment.

T J Howe, H A Claireaux, G Morgan, L McMenemy, S Masouros, A Ramasamy.

Presenting author:

Captain Thomas Howe RAMC
CT1

Pelvic binders can maintain sufficient tension to enable evacuation in laboratory studies however, field performance is unquantified. Binders applied pre-hospital are typically sub-optimally positioned reducing efficacy. It is unclear whether this is a result of user-error or displacement during evacuation.

The SAM Sling, T-POD and Prometheus (PROM) pelvic binders alongside the improvised Field-Expedient Pelvic Splint (FEPS) were evaluated during military training. Time to application and measurement of binder displacement (against a 45mm null-hypothesis) throughout a simulated patient evacuation was conducted six times per binder.

Mean application times varied: SAM 35s, TPOD 88s, PROM 175s, FEPS 184s. The FEPS, SAM, and TPOD did not displace beyond 45mm in any trial ($p < 0.01$).

Evacuation has minimal impact on binder placement. The FEPS is a viable improvised binder in extremis when proprietary devices are unavailable.



Preventing complications of deep infection in complex hosts: using D.A.C. with bone and joint surgery.

Maj H Smith, Mr SS Jameson (FRCS, PhD), Mr WGP Eardley (FRCS)

Presenting author:

Major Helen Smith RAMC
CT2

Prevention of deep infection following orthopaedic surgery influences outcome. Cost to the patient of skin loss, sinus, pain and discharge is considerable. Deep infection costs eight times that of a non-infected index procedure. Interventions to prevent complications are valuable to surgeons and patients alike.

We present 55 cases in selected, complex hosts (35 arthroplasty and 20 trauma) utilising D.A.C. as part of surgical management for confirmed deep infection.

Two cases had a subsequent procedure for infection (single stage revision and amputation). The remainder were infection free at a minimum follow-up of 6 months.

For selected, high-risk cases, the inclusion of D.A.C. in a multifactorial approach to implant infection management is now central to our practice. In a patient group where risk to reward ratio is extreme, we commend the use of D.A.C. to optimise patient outcome.



Human Augmentation in the Military Musculoskeletal Context - Current Concepts and Review of the Literature

Maj K Milne, Lt Col N Eisenstein

Presenting Author:

Major Kirsty Milne RAMC

ST5

Human Augmentation (HA) has been highlighted by DCDC as a means through which UK Defence will “transform the force through science, innovation and technology”. The goal being improved performance, providing a significant advantage in an increasingly unpredictable battle space.

This work reviews HA in the context of military musculoskeletal medicine and physical performance. The goals of HA are explored and current HA literature is reviewed; including areas such as exoskeletons, prosthetics, and wearable technologies. Considerable gains have been made in these areas. However, none of these present an option ready for widespread rollout. Barriers to HA are discussed: practical, ethical, legal but perhaps most importantly, financial.

In conclusion, in an era where the pace of warfare is limited by cost, the economic argument against HA seems insurmountable, particularly when the aims of HA may be met by simpler (cheaper) means.



Abdominal Aortic Junctional Tourniquets – Clinically Important Increases in Pressure in Aortic Zone 1 and Zone 3 in a Cadaveric Study Directly Relevant to Combat Medics Treating Non-Compressible Torso Haemorrhage

Capt T Smith, Prof I Pallister, Col P Parker

Presenting author:

Captain Tom Smith RAMC
GDMO

'Non-compressible' torso haemorrhage (NCTH) is the leading cause of preventable battlefield death, with 85.5% mortality. Insufflation, intraperitoneal fluid and foam studies in animals demonstrate significant haemorrhage reduction from visceral and vascular injuries. These are not CMT/Medic-delivered interventions. AAJT-S application takes 30s and reproducibly externally completely occludes the aorta in Zone 3. We examined the AAJT-S as a potentially minimally invasive intervention for medics to tamponade haemorrhage in Zone 1, by proximal epigastric compartment pressure.

Four unembalmed cadavers had AAJT-S applied; epigastric and intrapelvic pressures were measured, repeated with 500ml fluid as simulated intra-abdominal haemorrhage. Epigastric compartment pressures of c40mmHg were achieved throughout likely causing a significant and titratable reduction in coeliac trunk blood flow. BMI was not clinically significant.

AAJT-S should be a medic's point-of-injury intervention contributing to clot stabilisation and non-surgical haemorrhage control for torso and pelvic bleeding.

ABSTRACTS

Rapid fire presentations



SESSION 1

External Fixators in Austere Environments under Surge Capacity Conditions: A Systematic Review

David Bull, Mark Sykes, Mehdi Saeidi, Anthony M J Bull

Presenting author:

Dr David Bull

FY2

Surgical treatment for high-energy open fractures in the austere environment is challenging. External fixators provide definitive management in many cases, due to injury complexity, resource availability and to limit complications.

This systematic review examines external fixators in 33 publications, used across diverse locations: the Balkans, South Asia, Africa, and the Middle East.

Commercial and non-commercial fixators showed varied clinical outcomes (rates of union, nonunion/delayed union, loosening, infection, amputation), with no discernible difference between devices or locations.

The large variability in outcomes demonstrates the unpredictability of trauma injuries, and variability in fixator efficacy. While some non-commercial devices show promise, with comparable or better outcomes to the commercial devices, others had poor outcomes. Swift production of locally manufactured devices in austere settings could address surge capacity needs, though regulation and quality control of these remain challenges in their implementation.



A closed loop audit looking at open fracture management at a JHG

Authors: Surg Lt D L Mills, Ms Clare Taylor

Presenting author:

Surgeon Lieutenant Daniel Mills RN
CT2

Objectives:

To assess whether open fracture wounds were definitively closed within 72 hours of injury in a JHG.

Design:

After inclusion and exclusion criteria 40 patients were identified. If standards had been missed, the patients' paper and electronic notes were reviewed to look at reasons for this. Data from Q2 and Q3 of 2022/2023 was collected and compared to previous audit data from Q2-4 2021/2022 and Q1 from 2022/2023.

Results:

65% of patients failed to get definitive fixation and soft tissue closure within 72 hours of admission. This represented a deterioration from previous data collected. Of the patients that did not meet the standards, 71% were admitted between Thursday and Saturday, and 29% were between Sunday and Wednesday.

Conclusions:

NHS pressures are causing a worsening of patient trauma care. Day of admission affects time to definitive soft tissue closure.



Keeping it clean – challenges facing surgical sterilisation in the modern era

Major H Chandler

Presenting author:

Major Henry Chandler RAMC

Post-CCT fellow

Defence Medical Services doctrine states deployed healthcare will be benchmarked against comparable NHS standards. This includes the use of sterile surgical instruments. DMS has enjoyed many decades of secure logistics chains, ready access to power and water and the luxury of maintaining a static position for many months.

In the face of peer on peer conflict DMS must be prepared for casualties at a scale not experienced since the Falklands War, perhaps World War Two. Recent training serials have reflected this, but has due consideration been placed upon our rate limiting steps?

This paper explores the options available to DMS in the provision of suitable instruments to effectively deliver damage control surgery in any environment.



Orthopaedic Burden in Disaster

McIntyre J. Stewart S. Ramasamy A.

Presenting author

Major Josh McIntyre RAMC
ST5

Natural disasters present an increasing challenge to global healthcare due to climate and geopolitical instability. The orthopaedic burden is poorly understood. This scoping review aims to understand the requirements.

A review using MESH terms 'Orthopaedic Surgery' and 'Disaster' was performed. Eligibility criteria included those demonstrating the proportion of musculoskeletal burden, surgical intervention and anatomic distribution of injury/fracture.

602 studies were screened to 66 full texts analyses; of which 10 satisfied the criteria. Earthquake was the most common disaster; with musculoskeletal trauma representing the majority of injury presentations. In all but one study soft tissue wounds or fracture was the most frequent injury; with the most common surgical intervention wound debridement or fracture management.

This study is limited due to poor reporting standards. Local resource constraints and infrastructure limits surgical management. Standardised reporting systems would improve understanding and future care.



Pilot study of a Low-Cost, Light-Weight, 3D-Printed External Fixator for Trauma in Resource Limited Settings

Kyung-Hoon Moon, Chawezi Katete, Nathan Gallagher, Edson Kamba, Tim Beacon, Emily Spessert, Steve Mannion

Presenting author:

Major Kyung-Hoon Moon RAMC
ST3

Compound fractures are increasing globally. These require external-fixators, which can cost £5000. So-called 'low-cost' fixators on current market require significant manufacturing and high cost of transport - rendering them unaffordable and unavailable in austere settings. There is a need for low-cost, light-weight, sustainable external-fixator to manage compound fractures in austere settings.

Medical Aid International, Formula-1 design team and Feet First Worldwide (FFW), together have developed a light-weight external-fixator using 3D printer, costing less than \$100. The clamps can be autoclaved 10 times without strength loss.

Two open fractures and one malunion were treated with the external-fixator where no other fixation was available. The construct remained firm at day 3 and week 4 post-operatively without any complication.

This pilot study has shown the novel external-fixator to be cheap, light-weight and effective. Further clinical studies are planned.



SESSION 2

Whole body vibrations and lower back pain: A systematic review of current literature

Maj A Bainbridge, Dr I Moutsos, Maj A Johnson, Surg Lt Cdr L McMenemy, Col A Ramasamy, Dr S Masouros

Presenting author:

Major Abigail Bainbridge RAMC
CT2

Whole body vibration (WBV) is thought to be associated with low back pain (LBP) and a significant issue for SP due to the type of vehicle platforms used.

The systematic review was performed from January 1970 until April 2022. Studies focusing on LBP in association with WBV were included, specifically looking for military populations.

37 papers were included with a total population of 385497. LBP prevalence was 58.4%. 11 papers showed a statistically significant association between LBP and WBV. 9 papers measured WBV to ISO 2631 standards with 2 demonstrating a significant association. 2 papers reported on military populations.

This systematic review concluded that there is an association between WBV and LBP. There is a research gap for high-quality evidence. Military and female populations are under investigated and further research is needed to accurately address this question.



Risk Stratification Scoring System for Proximal Femur Bony Stress Injuries in Military Recruits

Surg Lt Ben Atkin RN, Ross Hemmingway

Presenting author:

Surgeon Lieutenant Ben Atkin RN
GDMO

At CTCRM, the 'Hip1' scoring system is used in the classification of patients presenting with proximal femur bony stress injury (BSI) symptoms into 'high' vs 'low' risk, to guide prospective management.

Retrospective cohort study to determine the effectiveness of the Hip1 score in identifying patients with a BSI affecting the proximal femur.

Of 47 eligible patients, 23 were identified as 'high risk' and 24 were identified as 'low risk'. 9/23 (39%) high risk group patients had a positive diagnosis of a BSI. Comparison between cohorts gave a Hip1 score 100% sensitivity, 63.2% specificity, a positive predictive value of 39.1% and a negative predictive value of 100%.

The Hip 1 scoring system can be of value in identifying which patients presenting with symptoms of BSI require specific management and referral for definitive diagnostic imaging.



X-ray templating in hemiarthroplasty – Is it a load of balls?

Maj H Smith, Maj A Bainbridge, Maj H Chandler

Presenting author

Major Helen Smith RAMC

CT2

It is standard practice in our centre for any pelvic x-ray for a suspected hip fracture to include a templating ball. We audited the use of templating x-rays to test its accuracy and determine if using a set magnification could act as a useful surrogate.

40 pelvic x-rays for hip fractures were assessed for adequacy and then used to template a hemiarthroplasty by 3 independent clinicians. The results were then compared to the documented implant used.

39 x-rays were adequate. The templated size matched the implant head size in 6 (15%) cases, 4 (10%) were greater than 5mm out. There was no correlation between the degree of magnification (average 127%) and the accuracy of templating.

Templating in hemiarthroplasties lacks accuracy and as such is of doubtful benefit when predicting implant head size.



An audit of orthopaedic waiting times in two DPHC medical centres and its consequences on medical discharges from the British Army

Capt J Kirkpatrick, Capt G Wilson

Presenting authors

Capt James Kirkpatrick RAMC, Capt Glen Wilson RAMC
GDMOs

Maximum waiting time for non-urgent consultant led treatment as stipulated by NHS England should be 18 weeks (126 days) from referral to treatment starting or discharge if no treatment is required. This audit compared orthopaedic waiting times for military patients to the NHS maximum standard to identify the impact on JMES grading.

DMICP notes of all patients referred to orthopaedics from DPHC Tidworth and DPHC St Athan between Jan 22 and Dec 22 were scrutinised. Mean time from referral to treatment was 238 ± 126 ($n=60$) and 173 ± 106 days ($n=21$) at Tidworth and St. Athan respectively. 17 and 11 patients at Tidworth and St. Athan were graded MND for >1 year, putting these patients at risk of medical discharge.

We hope to spark debate about how defence orthopaedic surgeons could help to reduce waiting times for service personnel.



Emergency Arthroplasty, the expanding epidemic of periarticular and periprosthetic fractures at a large Trauma Unit. The BUCKs Health Experience

R Myatt, J McNamara, N Beattie

Presenting author:

Surgeon Lieutenant Commander Richard Myatt RN
ST8

Trauma units need to ensure they are appropriately provisioned to meet the increasing demand of arthroplasty for trauma. The aim of the study was to quantify the operative trends in arthroplasty for trauma and periprosthetic fracture management in order to inform multidisciplinary work force planning and operational service improvement strategies.

A retrospective review of theatre records was undertaken between 2012 – 2022. There was an annual increase in THR for intracapsular NOF fractures and increase in surgical management for periprosthetic fractures of the hip. Emergence of TKRs for trauma whilst revision TKRs and distal femoral replacements has increased steadily.

Total hip arthroplasty and periprosthetic fracture management is increasing year on year. The trust will now review work force planning to ensure key performance indicators can be met. Implant stock and industry contracts need to be reviewed in order to drive operational efficiency and meet GIRFT targets.



SESSION 3

Outcomes and Predictors of Non-Union in Midfoot Arthrodesis

A Reynolds, CS Kumar

Presenting author:

Angus Reynolds

Medical Student

This study aimed to investigate objective and patient reported outcomes of midfoot arthrodesis. Secondary aims were to identify variables which may predict the development of non-union.

Retrospective analysis identified 108 patients (117 feet) at Glasgow Royal Infirmary who underwent midfoot arthrodesis from 2007-2019. Radiographs and notes were studied to record the rate of union and indications for further surgery. Patient reported outcomes were collected using the Manchester-Oxford Foot Questionnaire (MOx-FQ). Multivariate regression identified factors predicting the development of non-union.

Successful union was achieved in 87/117 (74%). Further surgery was required in 41/117 (35%). The rate of complications was 16/117 (14%). Overall MOx-FQ scores improved post-operatively by 19.25% ($p=0.002$). Bone grafts decreased the odds of non-union (OR=0.26, 0.01-0.72), whilst staple fixation increased the odds (OR=4.88, 1.37-17.35). Therefore, we recommend the use of bone grafts and the avoidance of fixation with staples.



Childcare Provision for On-Call Workers in the NHS: Is the 24/7 Service Ideal Matched by Reality?

Flt Lt David Cain, Dr Ravi Patel, Col Paul Parker

Presenting Author:

Flight Lieutenant David Cain RAF
ST3

The UK's NHS strives for round-the-clock healthcare, with Major Trauma Centers (MTCs) crucial for this mission. Despite efforts to provide on-site nurseries for children aged 3 months to 5 years, a gap remains in childcare provision for on-call workers, notably surgeons and nurses. This gap raises concerns about supporting healthcare professionals with irregular schedules.

This study explores childcare facilities in NHS MTCs, aiming to identify challenges and propose solutions. Research across 28 MTCs revealed that while 26 had on-site nurseries, few operated beyond standard hours, none offering emergency or weekend services. This shortfall contrasts sharply with private and other government sectors, potentially impacting career choices and retention, which has obvious ramifications amongst DMS personnel as well. Urgent reforms are needed to align childcare with NHS operational demands, ensuring support for on-call workers and their families.



Orthopaedic theatre radiation protection provision: Is it adequate?

L McMenemy, H Sevenoaks, J. Richards, S. Howles, A. Mountain, D. Bose

Presenting author:

Surgeon Lieutenant Commander Louise McMenemy
ST6

Studies have linked breast cancer to radiation exposure in orthopaedic surgeons. The aim was to assess the adequacy of lead gown provision for trauma theatre use.

Audits comparing lead gown provision to Orthopaedic surgeon demographics were undertaken across Northwest England, West Midlands, and Wessex. Adequate gowns were defined as correctly sized, provided wrap-around protection with $\geq 0.25\text{mm}$ lead weight equivalence (International Atomic Energy Agency).

Only 28.8% of gowns were adequate for use by Orthopaedic surgeons ($n=253/878$). Over one third of surgeons have no access to adequate PPE (31.2- 47.7%).

In Wessex, the relative risk of not being able to access an adequate gown was 1.97 for males compared to 0.5 for females.

All trusts should appraise the current provision, improving to ensure adequate protection. Radiation PPE provision is inadequate regardless of gender. Further research should extend to the wider surgical team.



Effect of a perpendicular reference point on a surgeon's angle estimation as demonstrated by the effect of hip rotation on operative femoral anteversion.

P Raut

Presenting author:

Squadron Leader Pramin Raut RAF
ST6

Excessive anteversion or retroversion of a femoral stem in total hip replacements can cause clinically relevant reduction in range of motion and increase the risk of dislocation. Using a specifically built femur and tibia bone saw model to measure femoral stem version, 23 participants were asked to produce 15-degrees and neutral femoral stem anteversion with the hip in 30-degrees internal rotation and neutral rotation (tibia perpendicular to the ground) producing an average angular error of 8.4, 5.6, 5.4 and 3.5 degrees respectively. Surgeons were more accurate in producing the desired stem versions when the reference tibia was perpendicular to the ground.

Surgeons should be aware of limitations of visual estimation of femoral stem versions and intra-operative angles in general and the positive effect of perpendicular reference points when attempting to produce a desired angle intra-operatively.



Evaluation of Accuracy and Efficiency of Smart Taylor Spatial Frames in Deformity Planning: A Comparative Study

Packer, Fletcher, Graham, Burnand, Mitchell

Presenting author:

Major Timothy Packer RAMC
ST5

Taylor Spatial Frames (TSF) are vital in limb reconstruction. Traditional methods rely on manual input from radiographs for strut length prescriptions. Smith and Nephew's smart TSF software, with a Beacon attachment, uses radiostereometric analysis for orientation. This study compares manual and smart TSF methods' accuracy and efficiency.

Ten patients with uniplanar deformities were studied, with both methods executed by surgeons with varied experience. Primary outcome: standard error of strut lengths prescribed by smart TSF versus manual, considered the gold standard. Secondary outcome: programming time.

Similar final strut lengths between manual and smart TSF found with the consultant (less than 6 mm variation). Smart TSF, particularly when operated by the junior registrar, demonstrated slightly better accuracy and reduced programming time by three minutes. Smart TSF software holds promise, especially for less experienced users, offering improved accuracy, efficiency, and valuable planning features.

Guest Speakers



Mr Edward J O Wilson BA, LLB, DipPFS, Chartered ALIBF

Ted is a Chartered Financial Planner and heads Wilson Wealth Advisory, a Senior Partner Practice of St. James's place. He provides broad based advice to professionals, entrepreneurs and retired clients, helping them with practical solutions to the financial issues that concern them most. He has practiced as a financial adviser for 14 years, following a career in law in Canada, then investment banking and management consultancy in the UK. He has many clients in the medical profession and knows their world inside-out as both his parents were doctors. Working with private clients is the ideal way to combine his 30 years of professional experience with a love of working with individuals to understand them and help improve their lives.



Lieutenant Colonel Charlotte Tunstall RAMC

Charlotte joined the military as a Combat Medical Technician in the Territorial Army in 2000 and after qualifying from medical training at Leicester University in 2005 she transferred to the Regular Army where she went on to complete her Core Surgical Training before taking up Speciality Training within the Stoke/Oswestry Region. She achieved her CCT in 2021 and has subsequently completed Fellowships in Major Trauma at John Radcliffe Hospital, Oxford, and Complex Upper Limb Trauma at Leeds General Infirmary where she now practices as a consultant specialising in Major trauma and complex Upper Limb trauma including Elbow Arthroplasty. She sits on the Regional Clinical Co-ordinators committee for the National Joint Registry and she has a keen interest in undergraduate medical education. She has recently returned from deployment on Op Shader where she was part of the team who closed down the medical facility after over seven years of service. She lives in Shropshire with her ten year old daughter and partner.



Mr William Childs, Partner, Weightmans LLP

Formerly of RadcliffesLeBrasseur, William is a Partner in our health sector team. He advises clients in relation to disciplinary, regulatory and criminal investigations and prosecutions in the healthcare sector. As one of our team of advocates, William frequently appears before statutory regulators, disciplinary panels and coroners. William deals with professional performance, conduct and health concerns. His caseload consistently includes challenging cases which involve complex clinical and legal issues many of which are the subject of media interest. William is one of the many partners in the department ranked for professional discipline in the legal directories.

Guest Speakers



Colonel (Retd) Michael P M Stewart
CBE, QHS, FRCSG, FRCS (Tr & Orth), FRCS Ed (Ad Hom) L/RAMC

Born in Aberdeen, father, Royal Navy Officer. Educated Robert Gordon's College and University of Aberdeen. MBChB 1979; FRCS Glasgow 1987; FRCS (Tr&Orth) 1994; FRCS Edinburgh (Ad Hominem) 2012.

Senior House Officer in General Surgery, Aberdeen Royal Infirmary 1980 to 1982; Surgical Registrar Groote Schuur Hospital Cape Town, and the University of Cape Town 1983 to 1987.

Commissioned in the RAMC in the rank of Major 1987. Specialist in General Surgery Cambridge Military Hospital, Aldershot 1987 to 1989. Officer Commanding Field Surgical Teams in Nepal 1988; Belize 1989; and the First Gulf War 1990/91. Orthopaedic Senior Registrar to the Western Infirmary and the Royal Infirmary Glasgow 1991 to 1993, and the Queen Elizabeth Hospital Woolwich 1993 to 1995. Consultant Trauma and Orthopaedic Surgeon, the Duchess of Kent Military Hospital, Catterick Garrison, 1995 to 2003; and South Tees NHS Foundation Trust 2003 to 2024.

Consultant Advisor to Director General Army Medical Services 1996 to 2000; Defence Medical Services Consultant Advisor to Surgeon General, Programme Director of Training in Trauma & Orthopaedics and Chairman of Defence Medical Service's Orthopaedic Speciality Board 2000 to 2012. Officer commanding Field Surgical teams on active duty in the conflicts in Bosnia, Kosovo, Iraq, and Afghanistan. Honorary Surgeon to HM the Queen 2004 to 2012. CBE (Mil) 2010. Robert Jones Lecture 2009; Gordon Gordon-Taylor Lecture 2012.



Colonel Paul Parker L/RAMC

Col Parker joined the Army in 1983. After Regimental Service with 16/5 Lancers and 23 PFA he began surgical training at BMH Hannover in 1989. He then trained at QEMH Woolwich, the Cambridge Military Hospital, Aldershot. His trauma fellowship was at the R Adams Cowley Shock Trauma Center in 94/95 and he completed training on the Edinburgh Rotation CcT in 1998.

Wherever the army has gone in the last 30 years, so has he and in desperation the Army have seen fit to extend him for yet another year !

Guest Speakers



Colonel (Retired) David Standley L/RAMC

I joined the RAMC as an officer cadet in 1988 while at medical school at The London Hospital. On qualification in 1990 I started work at the Queen Elizabeth Military Hospital, in Woolwich. After completing my house officer posts and Post Graduate Medical Officer course, I was posted to Germany as RMO to 50 Missile Regiment, RA, and then BMH Iserlohn, as a surgical trainee. I completed my basic surgical rotations via the Cambridge Military Hospital and back at Woolwich. After a short time at the Royal Navy Hospital, Haslar, I started higher surgical training in the Southwest. It feels at times that my early career was spent closing military hospitals! I completed my orthopaedic training in December 2002 and worked initially in Derriford and then moved to the Princess Elizabeth Orthopaedic Centre, Exeter, where I continued until retirement in 2021. I became a consultant just in time for the start of Operation Telic. As a consultant I deployed to Telic on 3 occasions, Bosnia once, Herrick 4 times and Kandahar once. Throughout my career I enjoyed working with orthopaedic trainers, and this culminated with 3 years on the Specialty Advisory Committee for Trauma and Orthopaedics.

In the latter part of my consultant career I undertook a range of clinical management roles, namely Clinical Director on Telic (2007), Consultant Adviser T&O (2011-2014), Medical Director for Herrick 20B (2014) and Defence Consultant Adviser T&O (2015-2019). I retired from the military and my NHS practice in 2021 and have since spent much of my time working as Chairman of East Devon Golf Club, on the Jurassic Coast.



Group Captain Ian Sargeant OBE KHS DL

Group Captain Ian Sargeant was appointed as a consultant in 1997. From 1997-2002, he worked at MDHU Peterborough, and from 2002 to date he has been a consultant at Selly Oak, later to become Queen Elizabeth Hospital, Birmingham and RCDM. He has deployed variously with all three services. Has held the post of both DCA and MCD in the past.



Colonel Dmytro Los UAF

Colonel Dmytro Los studied at a medical college, a medical university, and a military medical academy. He served in the mechanized brigade as a surgeon, during the NATO mission in Kosovo from 2005-2006.

Since 2008, he has been a traumatologist at the Military Medical Clinical Center of the Western Region, and from 2011 he has been head of their trauma department, and took part in hostilities since 2014. His specialty fields are combat trauma, treatment of fractures, arthroscopy and prosthetics. He has been awarded the Knight of the Order of Danylo Halytskyi and People's Hero of Ukraine

Guest Speakers



Lieutenant Colonel Carl Meyer RAMC

Lt Col Meyer has a high volume practice in primary hip and knee arthroplasty. In addition to his work at The Robert Jones and Agnes Hunt Orthopaedic Hospital, Lt Col Meyer provides a general trauma service at the neighbouring Royal Shrewsbury Hospital. He has a particular interest in revision hip surgery for dislocation and revision knee surgery for knee instability. Qualifying from the University of Birmingham in 1996, Lt Col Meyer then underwent higher orthopaedic training on the Oswestry rotation. He was appointed as a Consultant Surgeon at RJAH in 2011.

As well as an NHS surgeon, Lt Col Meyer is a Reserves Army orthopaedic surgeon following his time serving with one tour to Iraq and three to Afghanistan.

Lt Col Meyer developed the Veterans Orthopaedic Service in 2014 - the first service of its kind within the UK. It was initially aimed at Veterans with hip and knee arthritis but has now grown to involve other orthopaedic subspecialties. Patients have attended the service from across the UK as well as from overseas.



Surgeon Commander Steve Mannion MA MChir DTM&H DMCC FRCS (Tr & Orth) RD

Steve Mannion is Head of the Department of Conflict and Catastrophe Medicine at St George's, University of London, combining this with a part time appointments as an NHS consultant orthopaedic surgeon in Blackpool and Preston. For up to six months a year he also undertakes orthopaedic education and training projects in the less developed world, and has extensive experience in humanitarian surgical projects in conflict areas, including Afghanistan, Sri Lanka and in the 1994 Rwandan genocide.

He has established clubfoot treatment projects in many less developed countries and is Medical Director of the Global Clubfoot Initiative. Steve is a lead clinician in the UK response to International Disasters and past Chairman of World Orthopaedic Concern (UK).

Guest Speakers



Group Captain (Retired) Jonathan Kendrew RAF

Jon commissioned into the Royal Air Force as a medical cadet in 1993 having spent his first two years at Medical School flying too much with the University of London Air Squadron. Following General Duties and basic surgical training, he was selected to join the DMS Orthopaedic cadre, passing ASCAB in 2009. Over the next 12 years he delivered military and civilian trauma care both as a Consultant at the Role 4 - Queen Elizabeth Hospital in Birmingham and on deployment. Jon enjoyed a blended Air Command staff and clinical tour from 2016 to 2018 before starting as the cadre DCA. He played a key role in the DMS Osseointegration service starting in 2014 prior to handing over the surgical care of the cohort to the NHS in 2021. Transitioning from his first career as a DMS Consultant in 2021, Jon is now based in the UAE and works as Iqarus's Regional Medical Director for Africa. Jon leverages his experience to enhance Iqarus projects across the continent. As the clinical lead for a plethora of clinical capabilities, Jon travels widely in Africa offering direct clinical support and elevates capabilities through remote mentoring and clinical leadership, ensuring that even in the most austere environments, excellence in healthcare is never compromised.



Colonel (Retired) Jon Clasper CBE L/RAMC, Emeritus Professor Imperial

Jon qualified from Glasgow University in 1986 and completed his basic surgical training in the armed forces. His higher surgical training included a year at the major trauma centre in Baltimore, USA, and 3 years at Oxford. At the end of his higher surgical training Jon was awarded a DPhil, for his research on external fixator pin track infection. He was appointed as an army consultant in orthopaedic surgery, with a subspecialty interest in shoulder and elbow surgery in 1999, based at Frimley Park Hospital. From 2009-14 Jon was the Defence Professor of Trauma and Orthopaedics, and in 2010 he was appointed as a Visiting Professor in Bioengineering at Imperial College London. As the first Clinical Lead in the Royal British Legion Centre for Blast Injury Studies (CBIS), Jon was responsible for the clinical direction of the research activities, ensuring they remained military trauma focussed. Jon retired from the army in 2019, and finally retired from the NHS in 2023.

Guest Speakers



Group Captain Alexander Bennett PhD FRCP MFSEM

Gp Capt Alexander Bennett joined the RAF in August 2000. He has been a Consultant in Rheumatology and Rehabilitation at the Defence Medical Rehabilitation Centre, Headley Court and Stanford Hall since October 2008, the Head of the Academic Department of Military Rehabilitation since June 2011 and was the RAF Consultant Advisor in Rheumatology and Rehabilitation between 20012-2019.

He was appointed Defence Professor of Rheumatology & Rehabilitation in March 2017 and Honorary Clinical Professor at the University of Loughborough in May 2018 and Honorary Principal Research Fellow Imperial College 2020

He is a clinical academic and has published widely in the fields of Rheumatology, Rehabilitation and Sports Medicine, in particular in the fields of early diagnosis and prognosis in seronegative inflammatory arthritis/spondylitis and trauma and musculoskeletal injury.

Gp Capt Bennett oversees all research at the Academic Department of Military Rehabilitation, which focuses on trauma rehabilitation and outcome, musculoskeletal injury and disease. He is the Chief investigator of the ADVANCE Study, a 20yr cohort study investigating medical and psycho-social outcomes of combat casualties with multimillion pound funding and is also principal investigator to another 3 large randomized controlled trials investigating interventions for musculoskeletal injury and supervising multiple PhD studies. He has successfully raised over £19million in grant funding for research for the benefit of military personnel.



Colonel Arul Ramasamy MA PhD FFSEM FRCS(Tr+Orth) L/RAMC

Colonel Arul Ramasamy is the Defence Professor of Trauma and Orthopaedics appointed through the Royal College of Surgeons of Edinburgh and heads the Academic Department of Military Trauma and Orthopaedics. He is a visiting Professor at Imperial College London. He qualified from Cambridge University in 2000 and joined the Army. Having served as RMO 1LI, he completed his Higher Surgical Training in Birmingham. He has a subspecialty interest in Foot and Ankle Surgery.

Arul completed his PhD in Bioengineering at Imperial College London on Lower Limb Blast Injuries and has maintained his academic interests. He has over 100 publications and has been awarded over £6m in grant funding. He is the current clinical lead of the Centre for Injury Studies at Imperial College London, where he supervises numerous PhD students.

Col Ramasamy was awarded the prestigious ABC fellowship by the BOA in 2018. He is a member of both the BOA Research Committee and the Specialty Advisory Committee for Trauma and Orthopaedic Surgery. He sits on the editorial board of the Bone and Joint Journal as the Foot and Ankle Specialty Editor and is the Associate Editor for BMJ Military Health.

Mess Dinner



A Black Tie Mess Dinner will take place on Friday 10th May at Royal Hospital Chelsea, Royal Hospital Road, SW3 4SR (for invitation holders only).

Please enter and depart through Chapel Gate (see map). ID is not required.

A champagne reception will commence at 1900hrs in the Figure Court, followed by a three course dinner in the Great Hall.

After dinner drinks will be held at Embargo Republica, 533b King's Rd, SW10 0TZ, with coaches departing from Chapel Gate at 2245hrs and 2315hrs.





