Hand and Wrist trauma: Antimicrobials and Infection Audit of Clinical Practice (HAWAII ACP) protocol

From Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), Botnar Research Centre, University of Oxford, Oxford, UK

Correspondence should be sent to S. Q. Shafi shiraz.shafi@nhs.scot

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S. Q. Shafi,[1] R. Yoshimura,[2] C. J. Harrison,[3] R. G. Wade,[4] A. V. Shaw,[5] J. P. Totty,[6] J. N. Rodrigues,[7,8] M. D. Gardiner,[3,9] J. C. R. Wormald[3]

[1]NHS Greater Glasgow and Clyde, Glasgow Royal Infirmary, Glasgow, UK
[2]York and Scarborough Teaching Hospitals NHS Foundation Trust, York, UK
[3]Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), Botnar Research Centre, University of Oxford, Oxford, UK
[4]Leeds Institute for Medical Research, University of Leeds, Leeds, UK
[5]Salisbury NHS Foundation Trust, Salisbury District Hospital, Salisbury, UK
[6]Centre for Clinical Sciences, Hull York Medical School, York, UK
[7]Clinical Trials Unit, University of Warwick Medical School, Warwick, UK
[8]Department of Plastic Surgery, Stoke Mandeville Hospital, Aylesbury, UK
[9]Department of Plastic and Reconstructive Surgery, Wexham Park Hospital, Frimley Health NHS Foundation Trust, Wexham, UK

Aims

Hand trauma, consisting of injuries to both the hand and the wrist, are a common injury seen worldwide. The global age-standardized incidence of hand trauma exceeds 179 per 100,000. Hand trauma may require surgical management and therefore result in significant costs to both healthcare systems and society. Surgical site infections (SSIs) are common following all surgical interventions, and within hand surgery the risk of SSI is at least 5%. SSI following hand trauma surgery results in significant costs to healthcare systems with estimations of over £450 per patient. The World Health Organization (WHO) have produced international guidelines to help prevent SSIs. However, it is unclear what variability exists in the adherence to these guidelines within hand trauma. The aim is to assess compliance to the WHO global guidelines in prevention of SSI in hand trauma.

Methods

This will be an international, multicentre audit comparing antimicrobial practices in hand trauma to the standards outlined by WHO. Through the Reconstructive Surgery Trials Network (RSTN), hand surgeons across the globe will be invited to participate in the study. Consultant surgeons/associate specialists managing hand trauma and members of the multidisciplinary team will be identified at participating sites. Teams will be asked to collect data prospectively on a minimum of 20 consecutive patients. The audit will run for eight months. Data collected will include injury details, initial management, hand trauma team management, operation details, postoperative care, and antimicrobial techniques used throughout. Adherence to WHO global guidelines for SSI will be summarized using descriptive statistics across each criteria.

Discussion

The Hand and Wrist trauma: Antimicrobials and Infection Audit of Clinical Practice (HAWAII ACP) will provide an understanding of the current antimicrobial practice in hand trauma surgery. This will then provide a basis to guide further research in the field. The findings of this study will be disseminated via conference presentations and a peer-reviewed publication.

Bone & Joint Open

Take home message

- Hand and Wrist trauma: Antimicrobials and Infection Audit of Clinical Practice (HAWAII ACP) is the first international audit of antimicrobial practice used in hand trauma surgery. This study will provide a description of current antimicrobial practice in this field on a global scale.
- These data will aid researchers in future prospective studies on optimum methods to reduce surgical site infections following hand trauma surgery.

Introduction

Hand trauma, compromising injuries of the hand and the wrist, is common worldwide. The global age-standardized incidence of hand trauma exceeds 179 per 100,000 with prevalence rates static over the last three decades.[1] They are the most common type of injury treated in emergency departments, accounting for one in five attendances.[2-5] Hand trauma often results in significant costs to both healthcare and society.[6] The majority of which require surgical management.[7] A study using the Dutch Injury Surveillance System calculated that hand trauma was the most expensive injury type, above lower limb fractures and brain injuries.[6]

Surgical site infections (SSIs) encompass up to 20% of all healthcare associated infections and 5% of all surgical patients develop an SSI.[8,9] SSI following hand surgery are associated with antibiotic prescriptions, prolonged hospital stays, delayed rehabilitation, further operative procedures, increased morbidity, and potential mortality.[10-18] A recent systematic review of over 350,000 patients has shown the overall risk for SSI following hand trauma is consistent with other forms of surgery, at 5%.[19] SSI also results in significant costs to healthcare systems.[20] It has been estimated that SSI following all types of upper limb surgery costs over £450 per patient, with costs being as high as £3,900 for patients requiring longer admissions due to SSI.[21]

There is no consensus within the literature on the ideal management of hand and wrist trauma to reduce SSI.[19,21-25] The World Health Organization (WHO) have produced globally used guidelines to help prevent SSIs.[14] However, it is unclear what variability exists in the adherence to these guidelines within hand trauma surgery, which usually involves clean, contaminated, or dirty surgery depending on the injury.

Due to the ongoing public health crisis surrounding antimicrobial resistance, strategies for reducing the rate of SSI in hand and wrist trauma are a research priority. Patients, the public, and clinicians have also identified this as a priority during the 2017 James Lind Alliance Priority Setting Partnership (JLA PSP) for Common Hand and Wrist Conditions.[26] In order to tackle this research priority, we must assess what is currently being implemented to reduce SSIs in hand trauma. The aim of this audit is to evaluate adherence to the WHO global guidelines in prevention of SSI in the context of hand trauma surgery.

Methods

The primary aim is to audit adherence to pre-, intra-, and postoperative audit standards in reducing the risk of SSIs following hand trauma surgery. The secondary aim is to define the current antimicrobial practice used in hand trauma surgery.

Study design

This will be an international, multicentre audit comparing antimicrobial practices in hand trauma surgery to the standards outlined by WHO. Through the Reconstructive Surgery Trials Network (RSTN), hand surgeons across the globe will be invited to participate in the study. The study will run for eight months, starting at the end of November 2023 until the end of July 2024. All units (plastic and orthopaedic surgery) that operate on hand trauma will be invited to participate in the audit. Within each site, a team consisting of a consultant or associate specialist and one of the following: doctors in training, advanced or surgical care practitioners, hand therapists, research nurses, and medical students will be created. The team will be required to collect data on a minimum of 20 consecutive patients. Multiple collaborator teams can be present within each unit, consisting of one consultant and one health professional from the above list.

Data will be collected on the adherence to the audit standards. Data will also be collected on the type and mechanism of injury alongside initial, operative, and postoperative hand trauma management. A full list of required data fields are available in the Supplementary Material.

The audit will be piloted across four centres prior to commencing data collection to ensure ease, accuracy, and confidentiality of data capture and inform recruitment of collaborators. Support in disseminating and running this audit will be sought from professional associations, such as the British Association of Plastic, Reconstructive and Aesthetic Surgery (BAPRAS), the British Society for Surgery of the Hand (BSSH), and the British Association of Hand Therapists (BAHT).

Centre eligibility

The Hand and Wrist trauma: Antimicrobials and Infection Audit of Clinical Practice (HAWAII ACP) will be open to all hospitals worldwide with hand trauma surgery services. All participating centres are required to register the audit according to their local regulations. The audit will collect only routine, anonymized data with no change to clinical care pathways. In the UK, the study will be registered as a clinical audit in each participating centre. The trust's Caldicott Guardian's permission will also be sought for data collection.[27] For international centres, the study will be registered appropriately following local protocols. Proof of registration will be required before collaborators are able to begin data collection.

Patient eligibility

Study participants for the audit will be all patients deemed to require surgery following hand trauma. In patients with bilateral or multiple hand trauma requiring operative management, data will be entered for all injuries as per one case, maintaining each patient as the unit of analysis. This is due to the assumption that preventative practice remains the same for all surgical sites per patient.

Inclusion/exclusion criteria

Adults and children undergoing surgery for hand and wrist trauma will be included, while patients with infected wounds or found to have an infected wound at surgery will be excluded.

Outcomes

The primary outcome is adherence to relevant WHO global guidelines (Table I) for prevention of surgical site infection in relation to hand trauma surgery (%). The secondary outcome is a description of current antimicrobial practice in hand trauma surgery (e.g. number of hospitals that are routinely employing antimicrobial sutures and the most commonly prescribed antibiotics).

Data governance

Study data will be collected and managed using Research Electronic Data Capture (REDCap).[28,29] REDCAP is an electronic data capture tool hosted at Kennedy Institute of Rheumatology at the University of Oxford, and is a secure, web-based software platform designed to support data capture for research studies, providing: 1) an interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources.

Anonymized data will be entered into the REDCap system. Login details will be supplied to collaborators once local written approval is shared with the core study team. A REDCap-generated ID number will be assigned to each patient in the study. Only REDCap IDs and no patient-identifiable data will be transferred centrally. Data will be handled in accordance with local data governance policies, with collaborators being advised to destroy all paper copies of patient-identifiable information within confidential waste bins once uploaded to REDCap.

Data analysis

Analysis will be undertaken using R statistical software v. 4.3.3 (R Foundation for Statistical Computing, Austria). Descriptive analysis will be performed for all captured data. Audit standards will be categorized by individual WHO criteria. Dichotomous, categorial, and short ordinal data will be summarized using counts and percentages. Long ordinal and continuous data will be summarized via an appropriate mean with 95% confidence intervals. Each participating hospital will be able to download their own data.

Authorship

Teams who have submitted a minimum of 20 complete records will be eligible for co-authorship on all publications originating from the study, provided participation in the writing or approval of final manuscripts are met. Teams providing fewer than 20 complete records or those who choose not to participate in writing and approving manuscripts will be named under acknowledgments.

Ethics

HAWAII ACP is an audit of current methods of antimicrobial practice following hand trauma surgery, and it will not influence patient management. Therefore, national research and ethical approval are not required. All UK centres require the study to be registered as a clinical audit and local Caldicott Guardian approval for data to be shared outside their trust via REDCap. Internationally, collaborators are responsible for ensuring the correct audit or departmental approval has been achieved prior to commencing data collection. Patients do not need to provide written consent for data to be collected and analyzed in this study as the data collected will be anonymous and standard care pathways unaltered.

Patient and public involvement

Neither patients nor the public were involved in the study design.

Impact and dissemination

The findings of this study will be disseminated via conference presentations and a peer-reviewed, open access publication. Along with other feasibility data,[24,30] HAWAII ACP will aid researchers in conducting future prospective studies in minimizing the risk of SSIs in hand trauma.

Discussion

HAWAII ACP is an international audit evaluating adherence to the WHO guidelines in prevention of SSI following hand trauma surgery. HAWAII ACP will provide an understanding of the current antimicrobial practice in hand trauma surgery. This will then provide a basis to guide further research in the field.

The evidence base for hand surgery is lacking in terms of high-quality studies. There are few randomized controlled trials (RCTs), with the majority of studies being retrospective and observational.[31] Of the few existing RCTs, most are performed with poor methodology and are at a high risk of bias. A review of 207 hand surgery RCTs, published between 1982 and 2020, showed that 179 trials (86%) were single-centre. Only 38 trials (18%) were registered trials, and six trials (3%) had a published protocol.[32] Most studies were unblinded and had unclear descriptions of randomization and allocation concealment, resulting in high risk of bias.[32] Another review of 125 RCTs in hand surgery highlighted that only 38 trials (30%) conducted a power analysis and ten trials (8%) an intention-to-treat analysis. The authors conclude that although there is an increase in the quantity of RCTs in hand surgery within recent times, the quality of the research remains poor.[33] This is now changingwith their value being better understood by the hand surgery community.[34]

At present, there are no recognized guidelines on mitigating SSI risk following hand trauma surgery. Techniques employed by surgeons lack robust evidence regarding their utility. There are only eight trials evaluating antimicrobial techniques in hand trauma surgery,[35–42] five of which evaluated the effect of systemic antibiotics in open hand trauma, and three evaluated SSI after Kirschner (K)-wire fixation of hand and wrist fractures. A meta-analysis of studies assessing the use of antibiotics in open hand trauma revealed no significant distinction between antibiotic use or not. However, the analysis was hindered by poor data quality, preventing accurate conclusions.[23] A meta-analysis examining whether K-wires should be buried following upper limb fracture fixation encountered similar issues.[43] While the review did show an indication that burying may lower SSI risk, the RCTs were conducted with high risk of bias and so practice remains unguided.[43]

The WHO guidelines to prevent SSI comprises of pre-, intra-, and postoperative interventions have been designed for all surgical specialities and are not hand surgery-specific. The antimicrobial interventions used in the guidelines have been based on evidence from other surgical fields.[14] Within hand

Table I. Relevant audit standards from the World Health Organization global guidelines for the prevention of surgical site infection.[14]

Topic	Recommendations
Preoperative measures	
Optimal timing for preoperative SAP	SAP should be administered prior to the surgical incision when indicated (depending on the type of operation). The administration of SAP within 120 minutes before incision, while considering the half-life of the antibiotic.
Surgical site preparation	The use of alcohol-based antiseptic solutions based on chlorhexidine gluconate for surgical site skin preparation in patients undergoing surgical procedures.
Hair removal	Hair should either not be removed or, if absolutely necessary, it should be removed only with a clipper. Shaving is strongly discouraged at all times, whether preoperatively or in the operating theatre.
Surgical hand preparation	Surgical hand preparation should be performed by scrubbing with either a suitable antimicrobial soap and water or using a suitable alcohol-based hand rub before donning sterile gloves.
Preoperative and/or intraoperative measures	
Perioperative discontinuation of immunosuppressive agents	To not discontinue immunosuppressive medication prior to surgery for the purpose of preventing SSI.
Perioperative oxygenation	Adult patients undergoing general anaesthesia with tracheal intubation for surgical procedures should receive an 80% fraction of inspired oxygen intraoperatively and, if feasible, in the immediate postoperative period for two to six hours to reduce the risk of SSI.
Maintaining normal body temperature (normothermia)	The use of warming devices in the operating theatre and during the surgical procedure for patient body warming with the purpose of reducing SSI.
Use of protocols for intensive perioperative blood glucose control	The use of protocols for intensive perioperative blood glucose control for both diabetic and non-diabetic adult patients undergoing surgical procedures to reduce the risk of SSI.
Maintenance of adequate circulating volume control/normovolemia	The use of goal-directed fluid therapy intraoperatively to reduce the risk of SSI.
Drapes and gowns	Either sterile, disposable non-woven or sterile, reusable woven drapes and gowns can be used during surgical operations for the purpose of preventing SSI. Not to use plastic adhesive incise drapes with or without antimicrobial properties for the purpose of preventing SSI.
Incisional wound irrigation	Currently, insufficient evidence to recommend for or against saline irrigation of incisional wounds before closure for the purpose of preventing SSI. Recommend the use of irrigation of the incisional wound with an aqueous Povidone-iodine solution before closure for the purpose of preventing SSI, particularly in clean and clean-contaminated wounds. Antibiotic incisional wound irrigation should not be used for the purpose of preventing SSI.
Prophylactic negative pressure wound therapy	The use of prophylactic negative pressure wound therapy in adult patients on primarily closed surgical incisions in high-risk wounds for the purpose of the prevention of SSI, while taking resources into account.
Antimicrobial-coated sutures	The use of triclosan-coated sutures.
Postoperative measures	
SAP prolongation	Recommend against the prolongation of SAP after completion of the operation for the purpose of preventing SSI.
Advanced dressings	Not to use any type of advanced dressing over a standard dressing on primarily closed surgical wounds for the purpose of preventing SSI.

SAP, surgical antibiotic prophylaxis; SSI, surgical site infection.

trauma, there are no RCTs evaluating preoperative interventions aimed at reducing SSI risk. Intraoperatively, there is moderate evidence that burying K-wires can lower SSI risk. There is also evidence from observational studies that suggest the type of surgical preparation can influence SSI risk.[21] Finally, while trials do exist in postoperative interventions, they lack validity.[23]

The risk of SSI in hand trauma is high and comes with multiple complications.[19] It is an expensive injury afflicting healthcare systems worldwide.[21] There is a requirement for high-quality research in order to lower SSI risk. Feasibility data exist to inform RCTs in this field.[24,30] HAWAII ACP will build on this by providing a better understanding of the antimicrobial interventions used. This study will also develop a network of

clinicians and sites that can be harnessed in future studies of antimicrobials in hand trauma surgery.

Social media

Follow the HAWAII ACP on X @HawaiiTrial
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Supplementary material

List of required data fields for the Hand and Wrist trauma: Antimicrobials and Infection Audit of Clinical Practice (HAWAII ACP).

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Author information

S. Q. Shafi, MBChB, Specialised Foundation Doctor, NHS Greater Glasgow and Clyde, Glasgow Royal Infirmary, Glasgow, UK.

R. Yoshimura, MBBS, Clinical Teaching Fellow, York and Scarborough Teaching Hospitals NHS Foundation Trust, York, UK.

C. J. Harrison, BSc, MBBS, MBA, DPhil, MRCS, FHEA, Academic Clinical Fellow & Plastic Surgery Registrar
J. C. R. Wormald, MBBS(hons), PGDip(hons), MRes(hons), DPhil, MRCS, Plastic Surgery Registrar
Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), Botnar Research Centre, University of Oxford, Oxford, UK.

R. G. Wade, MBBS, MClinEd, MSc, MRCS, FHEA, GradStat, PhD, Academic Clinical Lecturer & Plastic Surgery Registrar, Leeds Institute for Medical Research, University of Leeds, Leeds, UK.

A. V. Shaw, MBBS, MRCS, Plastic Surgery Registrar, Salisbury NHS Foundation Trust, Salisbury District Hospital, Salisbury, UK.

J. P. Totty, MBBS, PGCHPE, PGCert, MRCS, MD, FHEA, Academic Clinical Lecturer & Plastic Surgery Registrar, Centre for Clinical Sciences, Hull York Medical School, York, UK.

J. N. Rodrigues, BSc(Hons), MBChB(Hons), MSc, MBA, PhD, FRCS(Plast), Associate Professor and NIHR Postdoctoral Fellow, Consultant Hand and Plastic Surgeon, Clinical Trials Unit, University of Warwick Medical School, Warwick, UK; Department of Plastic Surgery, Stoke Mandeville Hospital, Aylesbury, UK.

M. D. Gardiner, MA, PhD, FRCS(Plast), Honorary Departmental Senior Research Fellow, Consultant Hand and Plastic Surgeon, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), Botnar Research Centre, University of Oxford, Oxford, UK; Department of Plastic and Reconstructive Surgery, Wexham Park Hospital, Frimley Health NHS Foundation Trust, Wexham, UK.

Author contributions

S. Q. Shafi: Conceptualization, Writing – original draft.
R. Yoshimura: Methodology, Writing – review & editing.
C. J. Harrison: Methodology, Writing – review & editing.
R. G. Wade: Methodology, Writing – review & editing.
A. V. Shaw: Methodology, Writing – review & editing.
J. P. Totty: Methodology, Writing – review & editing.
J. N. Rodrigues: Methodology, Writing – review & editing.
M. D. Gardiner: Methodology, Writing – review & editing.
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