VASCULAR GROIN WOUND SURGICAL SITE INFECTIONS
Incidence

Systematic review of the literature on SSI incidence in vascular groin wounds

Current practice

The GIVE study

Prediction and Prevention

The GIVE risk prediction tools and systematic review of wound adjuncts to prevent groin wound SSIs

Future

ROSSINI-G
Common incision site
Consequences

- Increased antibiotics
- Increased LOS
- Increased critical care use
- Increased cost
Consequences
The vascular groin wound

Comorbidities and lifestyle habits

Wound location

3 - 34% vascular groin wound SSI incidence
Incidence

RCTs and observational
Adults undergoing arterial intervention
Groin SSI reported

MEDLINE
EMBASE
CENTRAL

Pre-existing infection
Trauma, cardiac, venous procedures
Incidence in the literature

- **117 studies**
  - **33 RCTs**
  - **84 observational**

- **65,138 incisions**
- **42,347 patients**

**SSI:**
- **Superficial:** 6.3%
- **Deep/organ/space:** 1.9%

**SSI:** 8.1%
### Study type influence

<table>
<thead>
<tr>
<th>Variable</th>
<th>All studies</th>
<th>Observational study and RCT</th>
<th>Observational study</th>
<th>RCT both arms</th>
<th>RCT intervention arm</th>
<th>RCT control arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI</td>
<td>1730/21431</td>
<td>1253/17424 (7.2)</td>
<td>477/4007 (11.9)</td>
<td>168/1838 (9.1)</td>
<td>289/1807 (16.0)</td>
<td></td>
</tr>
<tr>
<td>Superficial SSI</td>
<td>804/12786</td>
<td>526/11024 (4.8)</td>
<td>278/1762 (15.8)</td>
<td>115/849 (13.6)</td>
<td>166/915 (18.1)</td>
<td></td>
</tr>
<tr>
<td>Deep SSI</td>
<td>241/12863</td>
<td>211/11101 (1.9)</td>
<td>30/1762 (1.7)</td>
<td>11/849 (1.3)</td>
<td>20/915 (2.2)</td>
<td></td>
</tr>
</tbody>
</table>
## SSI definition influence

### Incidence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Studies that use the author’s definition of SSI or not reported</th>
<th>Observational study and RCT</th>
<th>Observational study</th>
<th>RCT both arms</th>
<th>RCT intervention arm</th>
<th>RCT control arm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SSI</strong></td>
<td></td>
<td>725/12004 (6.0)</td>
<td>595/10681 (5.6)</td>
<td>130/1323 (9.8)</td>
<td>36/513 (7.0)</td>
<td>88/614 (14.3)</td>
</tr>
<tr>
<td><strong>Superficial SSI</strong></td>
<td></td>
<td>288/7870 (3.7)</td>
<td>224/7294 (3.1)</td>
<td>64/576 (11.1)</td>
<td>15/215 (7.0)</td>
<td>47/329 (14.3)</td>
</tr>
<tr>
<td><strong>Deep SSI</strong></td>
<td></td>
<td>123/7870 (1.6)</td>
<td>108/7294 (1.5)</td>
<td>15/576 (2.6)</td>
<td>4/215 (1.9)</td>
<td>11/329 (3.3)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Studies that use a formal definition of SSI</th>
<th>Observational study and RCT</th>
<th>Observational study</th>
<th>RCT both arms</th>
<th>RCT intervention arm</th>
<th>RCT control arm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SSI</strong></td>
<td></td>
<td>1005/9427 (10.7)</td>
<td>65/6743 (9.8)</td>
<td>347/2684 (12.9)</td>
<td>132/1325 (10.0)</td>
<td>201/1193 (16.9)</td>
</tr>
<tr>
<td><strong>Superficial SSI</strong></td>
<td></td>
<td>516/4916 (10.5)</td>
<td>302/3730 (8.1)</td>
<td>214/1186 (18.0)</td>
<td>100/634 (15.8)</td>
<td>119/586 (20.3)</td>
</tr>
<tr>
<td><strong>Deep SSI</strong></td>
<td></td>
<td>118/4993 (2.4)</td>
<td>103/3807 (2.7)</td>
<td>15/1186 (1.3)</td>
<td>7/634 (1.1)</td>
<td>9/586 (1.5)</td>
</tr>
</tbody>
</table>
### Primary outcome influence

#### Incidence

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<tr>
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</tr>
</thead>
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<tr>
<td><strong>SSI</strong></td>
<td>1430/15638 (9.1)</td>
<td>927/12086 (7.7)</td>
<td>451/3552 (12.7)</td>
<td>164/1706 (9.6)</td>
<td>283/1673 (16.9)</td>
</tr>
<tr>
<td><strong>Superficial SSI</strong></td>
<td>671/10283 (6.5)</td>
<td>401/8812 (4.6)</td>
<td>270/1471 (18.4)</td>
<td>111/717 (15.5)</td>
<td>164/781 (21.0)</td>
</tr>
<tr>
<td><strong>Deep SSI</strong></td>
<td>205/10360 (2.0)</td>
<td>179/8889 (2.0)</td>
<td>26/1471 (1.8)</td>
<td>11/717 (1.5)</td>
<td>16/781 (2.1)</td>
</tr>
</tbody>
</table>

#### Studies where SSI not a primary outcome

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<tr>
<th>Variable</th>
<th>Observational study and RCT</th>
<th>Observational study</th>
<th>RCT both arms</th>
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<th>RCT control arm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SSI</strong></td>
<td>300/5793 (5.2)</td>
<td>274/5338 (5.1)</td>
<td>26/1455 (5.7)</td>
<td>4/132 (3.0)</td>
<td>6/134 (4.5)</td>
</tr>
<tr>
<td><strong>Superficial SSI</strong></td>
<td>133/2503 (6.8)</td>
<td>125/2212 (5.7)</td>
<td>8/291 (2.8)</td>
<td>4/132 (3.0)</td>
<td>2/134 (1.5)</td>
</tr>
<tr>
<td><strong>Deep SSI</strong></td>
<td>36/2503 (1.4)</td>
<td>32/2212 (1.5)</td>
<td>4/291 (1.4)</td>
<td>0/132 (0)</td>
<td>4/134 (3.0)</td>
</tr>
</tbody>
</table>
Regression results to predict SSI incidence

SSI being a primary outcome

Aneurysmal pathology (relative to occlusive)

Retrospective observational design (relative to RCT)
Conclusion from review

SSI: 8.1%

- Superficial: 6.3%
- Deep/organ/space: 1.9%
Groin wound Infection after Vascular Exposure (GIVE) Multicentre Cohort Study

The GIVE Study Group$^1$

1. Vascular and Endovascular Research Network (VERN)
Aims

• To calculate a contemporaneous incidence of groin SSIs
• To identify patient, surgical and theatre risk factors
• To identify areas of equipoise

“How can we reduce surgical site infections in vascular surgery?”
Current practice

- GIVE first advertised at VS 2018
- Disseminated via personal contacts and social media
- Inadvertent international enthusiasm

January 2019: Study open for centre enrolment
May 2019: Study closed to new site enrolment

Local audit approval

3 months prospective data collection of consecutive patients
3 months follow up

August 2019: Last patient enrolled into study
November 2019: Last day of follow up
December 2019: Presented at VS
Current practice

Inclusion criteria

- Emergency or elective
- Exposure for endovascular procedure

Exclusion criteria

- Infected cases
- Venous access/harvest only
- Cardiac procedures

- Centre reported outcomes of SSIs (CDC criteria)
- SSIs reported to vascular team (no extra/additional follow up)
- Pseudoanonymised data sent to GIVE team
- Data validation of 5% of data set
- Target: 400 groin incisions
GIVE
Groin Wound Infection After Vascular Exposure Audit

34 centres (30 within the UK)
1337 groin incisions - 1039 patients

Current practice

SSI rate (%) vs N groin incisions

Data
Average

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Brenig.Gwilym@wales.nhs.uk

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Incidence in the GIVE study
SSI: 8.6%

Superficial: 4.8%
Deep/organ/pace: 3.8%

Incidence in the literature
SSI: 8.1%

Superficial: 6.3%
Deep/organ/pace: 1.9%

32.2%: radiological/surgical drainage of fluid
11.4%: explantation of infected material

Coliforms: 60%
VRE: 4%
MRSA: 1%
Median length of hospital stay (IQR): 5 days (3 – 10)

AKI rate: 12.4%

90 day mortality: 5.2%

<table>
<thead>
<tr>
<th>Outcome</th>
<th>SSI</th>
<th>No SSI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS</td>
<td>6 (4-13)</td>
<td>5 (2-10)</td>
<td>0.003</td>
</tr>
<tr>
<td>Post-op AKI %</td>
<td>19.6 %</td>
<td>11.7 %</td>
<td>0.024</td>
</tr>
<tr>
<td>90-day mortality %</td>
<td>8.3 %</td>
<td>4.9 %</td>
<td>0.155</td>
</tr>
</tbody>
</table>
### Multivariate analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>1.708 (1.095 - 2.663)</td>
</tr>
<tr>
<td>BMI ≥30*</td>
<td>2.916 (1.511 - 5.626)</td>
</tr>
<tr>
<td>IHD</td>
<td>2.213 (1.471 - 3.330)</td>
</tr>
<tr>
<td>Skin Prep</td>
<td></td>
</tr>
<tr>
<td>Aqueous betadine**</td>
<td>2.784 (1.515 - 5.117)</td>
</tr>
<tr>
<td>Bypass/patch material</td>
<td></td>
</tr>
<tr>
<td>Vein***</td>
<td>2.420 (1.178 - 4.970)</td>
</tr>
<tr>
<td>Prosthetic***</td>
<td>2.556 (1.268 - 5.149)</td>
</tr>
<tr>
<td>Xenograft***</td>
<td>4.864 (2.427 - 9.748)</td>
</tr>
<tr>
<td>Operative time (hrs)</td>
<td>1.152 (1.022 - 1.299)</td>
</tr>
</tbody>
</table>

* Reference: Normal BMI
** Reference: Alcoholic chlorhexidine
***Reference: No bypass/patch
Current practice

- Largest UK vascular snapshot study to the best of our knowledge (unfunded)
- Benchmarked SSI incidence in groin incisions (true incidence probably higher)
- Identified patient and operative factors associated with SSIs
Systematic review and narrative synthesis of surgeons’ perception of postoperative outcomes and risk

N. M. Dilaver¹,², B. L. Gwilym¹, R. Preece², C. P. Twine³,⁴ and D. C. Bosanquet¹

¹Aneurin Bevan University Health Board, Royal Gwent Hospital, Newport; ²Academic Section of Vascular Surgery, Department of Surgery and Cancer, Imperial College London, London; ³Division of Population Medicine, Cardiff University, Cardiff; and ⁴Southmead Hospital, North Bristol NHS Trust, Bristol, UK

Correspondence to: Mr D. C. Bosanquet, South East Wales Vascular Network, Royal Gwent Hospital, Cardiff Road, Newport NP16 2UB, UK (e-mail: davebosanquet@hotmail.com)
Prediction and Prevention
Conclusion: Two models were created and internally validated that performed acceptably in predicting “all” and “deep” groin SSIs, outperforming current existing risk prediction models in this cohort. Future studies should aim to externally validate the GIVE models.
Prediction and Prevention

Groin wound Infection risk after Vascular Exposure

IN DEVELOPMENT, PLEASE DO NOT USE!
The following form estimates the chances of any groin wound infection after vascular exposure. It uses automatic defaults for missing values and re-calculates each time a value is modified.

Predicted chance of groin wound infection (%)

20.6

Input variables:
- Sex
- History of ischaemic heart disease
- Patch/graff material
- Skin prep
- BMI (Kg/m²)
- Operative time (hours)

Groin wound Infection risk after Vascular Exposure

IN DEVELOPMENT, PLEASE DO NOT USE!
The following form estimates the chances of any groin wound infection after vascular exposure. It uses automatic defaults for missing values and re-calculates each time a value is modified.

Predicted chance of deep groin wound infection (%)

0.663

Input variables:
- Sex
- History of diabetes mellitus
- Patch/graff material
- Skin prep
**Prediction and Prevention**

**Editor’s Choice – Systematic Review and Meta-Analysis of Wound Adjuncts for the Prevention of Gruin Wound Surgical Site Infection in Arterial Surgery**


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**Table: Odds Ratios (surgical site infection)**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>cNPII Events Total</th>
<th>Standard care Events Total</th>
<th>Odds Ratio (M-H, Random, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All studies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karl 2013(3)</td>
<td>3</td>
<td>50</td>
<td>0.47 (0.11, 1.99)</td>
</tr>
<tr>
<td>Matave 2013(9)</td>
<td>3</td>
<td>19</td>
<td>0.14 (0.04, 0.51)</td>
</tr>
<tr>
<td>Kuusie 2013(3)</td>
<td>5</td>
<td>40</td>
<td>2.24 (0.56, 10.00)</td>
</tr>
<tr>
<td>Sabat 2014(5)</td>
<td>1</td>
<td>30</td>
<td>0.23 (0.04, 1.24)</td>
</tr>
<tr>
<td>Fleming 2017(7)</td>
<td>2</td>
<td>73</td>
<td>0.41 (0.08, 2.19)</td>
</tr>
<tr>
<td>Lee 2017(7)</td>
<td>7</td>
<td>53</td>
<td>0.53 (0.19, 1.49)</td>
</tr>
<tr>
<td>Pieter 2017(20)</td>
<td>5</td>
<td>58</td>
<td>1.13 (0.57, 2.26)</td>
</tr>
<tr>
<td>Keane 2017(20)</td>
<td>6</td>
<td>59</td>
<td>0.43 (0.20, 0.93)</td>
</tr>
<tr>
<td>Enghardt 2018(3)</td>
<td>9</td>
<td>64</td>
<td>0.42 (0.17, 1.02)</td>
</tr>
<tr>
<td>Gobbi 2018(17)</td>
<td>13</td>
<td>66</td>
<td>0.31 (0.15, 0.65)</td>
</tr>
<tr>
<td>Heselmans 2020(1)</td>
<td>8</td>
<td>78</td>
<td>0.28 (0.12, 0.68)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>63</strong></td>
<td><strong>105</strong></td>
<td><strong>0.34 (0.23, 0.51)</strong></td>
</tr>
</tbody>
</table>

**Heterogeneity:** Test of $I^2 = 7.10$; $Q = 14.13$, $df = 10$ ($p = 0.21$); $F = 24$

Test for overall effect: $Z = 5.45$ ($p < .00001$)

**RCTs**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>cNPII Events Total</th>
<th>Standard care Events Total</th>
<th>Odds Ratio (M-H, Random, 95% CI)</th>
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</thead>
<tbody>
<tr>
<td>Karl 2013(11)</td>
<td>3</td>
<td>30</td>
<td>0.47 (0.13, 1.09)</td>
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<td>2</td>
<td>30</td>
<td>0.23 (0.04, 1.24)</td>
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<tr>
<td>Kuusie 2013(3)</td>
<td>3</td>
<td>30</td>
<td>0.33 (0.19, 1.46)</td>
</tr>
<tr>
<td>Fleming 2017(7)</td>
<td>3</td>
<td>38</td>
<td>0.13 (0.03, 0.82)</td>
</tr>
<tr>
<td>Lee 2017(7)</td>
<td>7</td>
<td>53</td>
<td>0.43 (0.20, 0.93)</td>
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<td>Pieter 2017(20)</td>
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<td>59</td>
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<td>64</td>
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<td>Enghardt 2018(3)</td>
<td>8</td>
<td>78</td>
<td>0.28 (0.12, 0.68)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
<td><strong>448</strong></td>
<td><strong>0.52 (0.25, 0.96)</strong></td>
</tr>
</tbody>
</table>

**Heterogeneity:** Test of $I^2 = 0.00$; $Q = 5.16$, $df = 7$ ($p = .54$); $F = 0$

Test for overall effect: $Z = 6.27$ ($p < .00001$)

**Observational studies**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>cNPII Events Total</th>
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<td>Fleming 2017(7)</td>
<td>2</td>
<td>73</td>
<td>0.41 (0.08, 2.19)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>165</strong></td>
<td><strong>0.49 (0.09, 2.60)</strong></td>
</tr>
</tbody>
</table>

**Heterogeneity:** Test of $I^2 = 1.56$; $Q = 7.57$, $df = 2$ ($p = .02$); $F = 7.4$

Test for overall effect: $Z = 0.03$ ($p = 46$)

Test for subgroup differences: $Q = 0.25$, $df = 2$ ($p = .88$); $F = 0$
Prediction and Prevention

- Local antibiotics did not reduce groin SSIs
- Subcuticular sutures (vs. transdermal sutures or clips) reduced groin SSI rates
- Wound drains, platelet rich plasma, fibrin glue, and silver alginate dressings did not impact SSI rates
Future

Imitation is the highest form of flattery.
~ Charles Caleb Colton
ROSSINI-G

Future

Lots of patients…
LOCAL WORK

Future

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Future

553 patients undergoing MLLA
12.8% developed a surgical-site infection

Short-term risk prediction after major lower limb amputation: PERCEIVE study
Brenig L Gwilym, Philip Pallmann, Cherry Ann Waldron, Emma Thomas-Jones, Sarah Milosevic, Lucy Brookes-Howell, Debbie Harris, Ian Massey, Jo Burton, Philippa Stewart, Katie Samuel, Sian Jones, David Cox, Annie Clothier, Adrian Edwards, Christopher P Twine, David C Bosanquet,
the Vascular and Endovascular Research Network (VERN) and PERCEIVE study group
Author Notes

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ROSSINI-G