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1 **Splenic embolisation practices within the UK : a National Survey**

2

3 **Keywords:** Trauma: Spleen: Embolisation

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5 Introduction

Splenic injury accounts for a large proportion of traumatic abdominal injuries and is associated with a high mortality (1). The AAST trauma grading attributes 5 grades of injury (2) where higher grade injuries, in which the patients are more likely to be unstable, are typically treated with emergency laparotomy and splenectomy, which is considered the gold standard treatment.

Splenic embolisation, by intentionally occluding the splenic or segmental splenic arteries is a potentially life-saving treatment in the context of acute trauma. It presents a less invasive alternative to splenectomy and also preserves splenic function. Despite its potential there remains much uncertainty within the IR, surgical and trauma community as to its role in the setting of splenic injury. Since trauma networks have been established within England in 2012 there has been a reduction in the rate of splenectomy and an increase in splenic artery embolisation, with 7.6% of blunt splenic injuries being embolised between 2012-2014. (3) The main benefits of non-operative management, in avoiding unnecessary additional tissue damage occurring at laparotomy, maximising residual splenic tissue and reduce length of hospital stay are well understood (4). Splenic salvage is also important given the requirement for life long antibiotic prophylaxis and high mortality associated with post splenectomy infection (5). However, a small number of patients after splenic embolisation may still require splenectomy if there is failure of the procedure to control haemorrhage, or from post splenic embolisation infarction with abscess formation (4). The delay that splenic artery embolisation may cause on definitive surgical splenectomy is also a concern in the context of splenic embolisation failure. Additional injuries, which may require a laparotomy are typically seen as a contraindication to splenic artery embolisation.

There is considerable variation in practice of rates of embolisation according to AAST grade, haemodynamic instability and associated injuries particularly within the US healthcare system (6-10). Although the variability in the UK setting is less well appreciated within the literature given the lack of national guidelines, with the advent of the trauma networks it is anticipated that the variability is reducing as procedural approaches may be standardised. In addition to the decision to proceed to embolisation there are a number of technical factors including the selectivity of the embolisation, the embolisation agent, subsequent imaging protocols and antibiotic therapy for which no clear evidence-based standard has emerged. This survey aims to demonstrate the UK IR community's current practice on splenic embolisation in the context of trauma.

Methods

An electronic survey was compiled using Google Forms, [REDACTED] [REDACTED] full members by email on 15th November 2021 and remained open for 2 weeks, closing on the 29th November 2021. The data was analysed in Microsoft Excel 365. Data obtained included the IR trauma service response, service design, typical treatment pathways and typical clinical decisions around splenic embolisation as well as a short retrospective case review.

Ethical approval was not required for this survey due to the retrospective and anonymous nature. Data was entirely anonymous at the time of data collection with no patient identifiable data being collected or shared outside of a hospital trust.

Results

A total of 62 responses were obtained, of which 38/62 (61.29%) worked at a Major Trauma Centre (MTC). A further 12 (19.35%) worked at a Trauma Unit (TU) and a further 12 did not

52 have a trauma network affiliation at their hospital. 44 (70.97%) operate as part of a 24/7 on-
53 call at their trust, with a further 6 (9.68%) operating a 24/7 networked on call system with
54 other trusts. 5 (8.06%) had some on call but this was not 24/7 with a further 7 (11.29%) not
55 operating any on-call system. Two respondents from MTCs did not offer 24/7 on-call despite
56 this being part of the Royal College of Radiology (RCR) and Trauma Audit Research Network
57 (TARN) standards on radiology provision for trauma.

58 The majority of respondents 48/62 (77.42%) had no direct involvement with the trauma team
59 until an eligible case had been reported by the diagnostic radiologists, with the remainder of
60 the respondents (n=14) having some sporadic involvement with attending or being pre-alerted
61 to the trauma team response.

62 Only 12 (19.35%) respondents were aware of a traumatic splenic injury protocol that involved
63 the IR team as part of the standard operating procedures of the trauma pathway. 55/62
64 (88.71%) of respondents did not have a standard follow up imaging pathway for conservatively
65 managed splenic injury in their trusts. 8/62 (12.9%) had a locally standard imaging pathway
66 post embolisation.

67 17/62 (27.42%) of IRs who responded recommended antibiotics for their patients post
68 embolisation. 35/62 (56.45%) of respondents routinely used the AAST grading system. Of those
69 who used the AAST grading system or were familiar with it to inform their decision (albeit not
70 routinely used) (32/62), 51% stated that they would consider embolising Grade 5 injuries, with
71 66% (41/62) stating they would embolise grade 4 injuries. Grade 3 and grade 2 injuries were
72 considered in 54% (34/62) and 12.9% (8/62) respectively . Figure 1 highlights the embolisation
73 treatment consideration according to AAST grade.

74

75

Discussion

This study highlights the current practice of splenic artery embolisation for acute traumatic splenic injury across the UK. This survey demonstrates that there is lack of consensus and wide variability in the UK IR community as to the best application of splenic embolisation in the acute traumatic setting, however this appears to be due to a lack of clear evidence and guidelines on its usage (11). 62 responses were received which represents approximately 13.5% of the current vascular interventional consultant IR workforce which is thought to be at 459 in 2021 (12). The response rate is difficult to accurately determine given that not all Vascular interventionalists will be members of [REDACTED] which has 592 consultant members on their mailing list, although many will not practice vascular interventions. This provides a substantial proportion of the workforce as a representative viewpoint. A larger number than proportional to workforce responded from a MTC setting, which likely reflects the interest in the topic being surveyed and an integral weakness of a survey format. Trauma Units are therefore underrepresented, although due to local standard operating procedures, many cases may be transferred to the trauma centre for embolisation.

12/62 (19.3%) of the respondents from MTCs stated they were not operating as part of a 24/7 on-call system, either as a single hospital or as part of a network. This has not significantly changed since the prior survey analysing trauma coverage within England in 2016 where 80% were providing 24/7 out of hours service, with a further 20% providing a reduced or no out of hours (Monday to Friday 9-5) service (13). Urgent investment in the provision of 24/7 IR services, in particular to MTCs is imperative in enabling emergency IR procedures. The provision of embolisation of a number of intra-abdominal organs is now considered important to trauma care of specific patients however the aortic (in particular descending thoracic aortic)

100 traumatic injuries are now almost universally managed with an emergency TEVAR (14). Specific
101 funding and support to develop a sustainable 24/7 IR service to at minimum cover MTCs is
102 required and may require the support of Trauma Units and associated colleagues to support
103 this service in keeping with the development of radiology networks put forward in the NHS
104 long term plan in 2019 (15).

105 Although the majority of hospitals had a 24/7 on-call (including networked arrangements) very
106 few IRs are directly involved with the Trauma Team, with the majority waiting for the diagnostic
107 report to identify an IR treatable injury. Whilst this may be essential to protect the scarce
108 resource of capable IRs and reduce the burden of trauma calls to the IR department, it
109 introduces a barrier for IRs involvement in the trauma team and removes the IR from the
110 decision making process. IRs who attend some or all of the Trauma calls may be well placed to
111 advocate for IR treatment and discuss the merits of embolisation rather than waiting for the
112 trauma team, often with senior surgical decision makers present, to make contact to discuss
113 the case. Further work to investigate the effect of the presence of IR decision makers in
114 attendance at the trauma call is required.

115 There are no clearly agreed and used national imaging protocols for conservative management
116 or post embolisation management of splenic injuries, with over 85% of respondents neither
117 having a standard pathway for conservative or post embolisation imaging follow up. Although
118 various imaging strategies are in place, the value and necessity of imaging post procedure and
119 in conservative management is uncertain and further studies are required. Only 27.4% (17/62)
120 of respondents recommended antibiotics post embolisation, which likely reflects both an
121 uncertainty around clinical need for antibiotic therapy as well as a lack of involvement in the
122 patients post procedure pathway. As IR becomes a more clinically focused specialty, the
123 involvement in key patient decisions post-procedure is essential. There is a lack of evidence

regarding this decision and further randomised controlled studies are required to guide practice.

There is wide variation between the IRs opinions on which AAST grade of splenic injury should be embolised, with only 32% of IRs considering embolisation for Grade 5 injuries. 83% suggested that grade 4 injuries would be considered for embolisation, increasing from 12.9% (8/62) for grade 2. Although various guidelines are available (5, 16-18) but there is no clear consensus within the UK IR community. A significant number of IRs stated that they did not use the AAST grading system, but preferred to use the presence of features such as pseudoaneurysms or active haemorrhage to guide intervention. It is well understood that CT angiography or the commonly used biphasic contrast, single phase acquisition trauma CT can underestimate the presence of splenic pseudoaneurysms (19), however diagnostic angiography does not appear to be widely utilised within the UK consultant body. Further research into the appropriateness of diagnostic catheter directed angiography for splenic injuries, should be undertaken to improve the decision to embolise and understand the conservative management failure rate.

The benefits of proximal or distal splenic embolisation are widely debated (20-22) and within the UK IR scene it is clear from our data that there is no consensus as to the benefits of either technique with 22.5% (14/62) stating they would typically attempt a selective embolisation compared to 35.4% (22/62), the remaining 26 stated that this would depend on the case. Typically, this was dependent on the identification of the bleeding point and the stability of the patient. Further research is required to determine the appropriate treatment technique in acute traumatic splenic injury and currently guidelines do not appear to be universally accepted.

The main limitation of this study is that it only captures a small percentage of the views of the IR community within the UK. The heterogeneity in viewpoint and lack of clear consensus in decision to embolise, technique used and post procedure management highlights the lack of clear evidence based guidance and need for further research in this area. Expert consensus guidelines may be required whilst high quality research is being undertaken and the lack of evidence in this area currently limits the impact of expert consensus opinion.

Conclusion

Wide variability exists in the splenic embolization practice and decision making within UK IR community. A UK wide IR consensus on managing traumatic splenic injuries is required to help facilitate decisions on embolization, treatment technique and post-embolisation imaging protocols. The lack of evidence around treatment options in traumatic splenic injury needs to be addressed to give strength to guidelines.

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225 Figure 1:

226 Percentage of respondents who would consider embolization according to AAST grade.