Author's response to reviews

Title: Prognostic Factors in Endovascular Treated Pelvic Haemorrhage after Blunt Trauma

Authors:

Rafael Rehwald (rafael.rehwald@student.i-med.ac.at)

Elisabeth Schönherr (elisabeth.schoenherr@i-med.ac.at)

Johannes Petersen (johannes.petersen@i-med.ac.at)

Hans Jeske (hans.jeske@i-med.ac.at)

Anna Fialkovska (Anna.Fialkovska@student.i-med.ac.at)

Anna Luger (anna.luger@i-med.ac.at)

Astrid Grams (astrid.grams@i-med.ac.at)

Alexander Loizides (alexander.loizides@i-med.ac.at)

Werner Jaschke (werner.jaschke@i-med.ac.at)

Bernhard Glodny (bernhard.glodny@i-med.ac.at;rafael.rehwald@student.i-med.ac.at)

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Author’s response to reviews:

Dear Professor Tu, Dear Professor Zingg!

Please find enclosed our revised manuscript „Prognostic Factors in Endovascular Treated Pelvic Haemorrhage after Blunt Trauma” for publication in “BMC Surgery”.

We would like to thank you for your editorial efforts and for extending the submission deadline, as this provided us with the additional time needed to comply with the Reviewers valuable suggestions. Furthermore, we would like to thank both of the Reviewers for taking the time to help to improve this work.

During the revision process, we critically revised the entire manuscript according to the improvements suggested especially by Reviewer 2. We were required to search all available patient records, digitalized as well as paper records, to retrieve as much information as possible. This task was done with great support of Ms. Anna Fialkovska. Additionally, Ms. Fialkovska critically revised the manuscript, performed an independent literature check and was involved in re-writing the manuscript. All authors jointly agreed that Ms. Fialkovska qualified for authorship
of this work in accordance with the applicable guidelines and recommendations (i.e. BioMed Central’s Authorship Policies).

Unfortunately, we were not able to access the page link provided in your e-mail to request the change in the author list. Therefore, we would kindly like to ask for your permission of this change by means of this letter. Should you require any further information, please do not hesitate to contact us.

We deeply hope that we can share our findings with the community by publication at this beautiful place for it, scilicet ”BMC Surgery”.

We are looking forward to hearing from you.

Yours Sincerely,

Bernhard Glodny and Rafael Rehwald

On behalf of all Authors

Editor Comments:

Please find the two reviewers' remarks below. As you will find, one of the reviewers raised several points that require revision.

Reviewer reports:

Reviewer 1:

Item #1-1:

Evolving concepts in major vascular trauma patients, well exposed by means of considerable experience.

Thank you very much for this statement!

We believe this topic is highly important, as we ourselves sometimes still hear reports other hospitals about patients with massive pelvic bleeding who have been surgically treated and whose overall outcome might still be fatal due to massive and uncontrollable bleeding once the retroperitoneal space was opened during surgery.

Unfortunately, we have witnessed a similar case recently. This patient had the lumbar artery injured after blunt pelvic trauma. The major endovascular problem was that the origin of the
artery had been ligated during surgery and could not be probed directly. The patient unfortunately did not survive due to the massive sequelae of blood loss, despite mass transfusions and in the end successful haemostasis.

Including the new data requested by Reviewer 2, we are able to show that surgical procedures before the first/initial interventional angiography are a predictor of redo-procedures, as the bleeding appears to start again after the successful first endovascular treatment.

We hope we might contribute to improve the awareness of the physicians responsible and to improve patient outcome and survival. Hemostasis appears to be of paramount interest, as blood loss proved to be one of the most important predictors for mortality.

Reviewer 2:

The study is lacking detailed results which are of major importance in judging the success of the management of pelvic trauma by radiological intervention and thereby drawing any conclusions.

Thank you very much for taking the time to critically review our manuscript!

The detailed results and valuable improvements suggested by the Reviewer have been included into the manuscript (as detailed below). The parameters requested by Reviewer 2 have been inserted into the “Materials and Methods” section, which can be found on page 9, line 12 – line 21.

Item #2-1

Results are required regarding lethality, (…)

Done as requested.

The number of deaths was already included in the manuscript, which can be found on page 9, line 17 now, and in tables 3 and 5.

As correctly suggested, we included the following figures for lethality, which was included into the results section on page 9, line 18 – line 19, and discussed on page 15, line 19 – line 26 and page 16, line 1 – 11.

Item #2-2

(…) amount of blood transfusions, (…)

Done as requested.

This task required the anesthesiologic records to be fetched from the (partially non-digitalized paper) archives.
The type and respective amount of blood transfusions have been compared between surviving and deceased patients in table 3. The reference to the table can be found in the text on page 9, line 21 in the results section.

Item #2-3

(…) length of intensive care stay, etc.

Done as requested.

The amount of blood products (any) received was 9.1 ± 14.4.

The length of intensive care stay was 19.0 ± 21.6 days.

The number of surgeries performed after angiography was 1.0 ± 1.1.

Item #2-4

The alternative treatment of surgical management (…)

After careful revision of all records we are able to state with confidence, that there was no alternative treatment such as i.e. pelvic packing during the observed study period. This statement can be found on page 6, line 11 – line 12. There were also no alternative attempts for surgical hemostasis before or after the angiography. Neither the retroperitoneal or the infraperitoneal space were opened in order to address the haemorrhage in any case.

However, pelvic binders were used in most of the patients routinely, with the exception of those patients who had been treated surgically before angiography and where external Fixateurs etc. have been applied (see below, Item #2-6).

Item #2-5

(…) and resuscitation with blood transfusions, clotting factors (…)

Done as requested.

The amount of blood transfusions has been addressed under Item #2-2, and clotting factors have been analysed retrospectively as well and the results have been inserted into the manuscript accordingly. However, we were retrospectively not able to assess how many patients formally fulfilled the criteria of pharmacologic resuscitation, using adrenaline, any similar or other drugs as well as blood products (Spahn DR, Bouillon B, Cerny V, Coats TJ, Duranteau J, Fernández-Mondéjar E, Filipescu D, Hunt BJ, Komadina R, Nardi G, Neugebauer E, Ozier Y, Riddez L, Schultz A, Vincent JL, Rossaint R. Management of bleeding and coagulopathy following major trauma: an updated European guideline. Crit Care. 2013 Apr 19;17(2):R76. doi: 10.1186/cc12685).
However, one can assume that all patients who received transfusions or fresh frozen plasma were either hemodynamically instable or threatened to become instable. Therefore, they could be regarded as hemodynamically unstable in retrospect, better defining the status of the patients.

Item #2-6

(…) and stabilisation techniques (as pelvic binder etc.) have not been mentioned and need to be formally addressed.

Pelvic binders were applied in most of the cases, but, however, could not be found in any of the records, maybe partly due to the fact that those measures were applied in the hospital in which the patient was initially admitted, or that it is might applied routinely in the emergency department without further record.

Furthermore, we tried to identify the patients in which pelvic binders were visible on any radiographs, following the publication of Bonner et al, JBJSB 2011 (Bonner TJ, Eardley WG, Newell N, Masouros S, Matthews JJ, Gibb I, Clasper JC Accurate placement of a pelvic binder improves reduction of unstable fractures of the pelvic ring. J Bone Joint Surg Br. 2011 Nov;93(11):1524-8. doi: 10.1302/0301-620X.93B11.27023) but failed, because there are different sorts of pelvic binders, some of them not clearly identifiable, and because they often have been removed in order to get access to the femoral artery ahead of the interventional angiography.

We could not identify the exact moment, in which the binder was applied, nor count how many patients have had a pelvic binder, and neither the moment in which the binders had been removed, or might have been applied again.

As we have concluded that only this limited information is not sufficient, we decided to not include data on pelvic binders into the manuscript. Of course, this limitation was included into the discussion section under “Limitations of the Study” and can be found on page 13, line 14 – line 18.

Item #2-7

One requires information regarding results of bleeding pelvic injuries within the same time interval of 15 years which were managed without radiological intervention, (…)

Done as requested.

With confidence, we can conclude from our data that there were no pelvic bleedings within the same time interval of 15 years which were managed without radiological intervention. It is due to our retrospective approach that we were able to identify all patients with pelvic bleeding after blunt trauma. This has been included into the “Methods” section into the manuscript, which can be found on page 5, line 20 – line 26, page 6, line 1 – 5.

Item #2-8
(...) in order to draw any conclusions. The simple fact that interventional radiological procedures can be helpful in bleeding pelvic injuries alone does not justify any of the conclusions which have been made in this manuscript.

This point has to be addressed in several ways.

We are not only aware of the fact, that there is still an ongoing controversy regarding the role of endovascular therapy, but as well that the different methods for hemostasis, i.e. pelvic packing may be complementary (Suzuki T, Smith WR, Moore EE. Pelvic packing or angiography: competitive or complementary? Injury. 2009 Apr;40(4):343-53. doi: 10.1016/j.injury.2008.12.006. Epub 2009 Mar 17.), and that the main cause of death in those patients is still exsanguination (Suzuki T, Smith WR, Moore EE. Pelvic packing or angiography: competitive or complementary? Injury. 2009 Apr;40(4):343-53. doi: 10.1016/j.injury.2008.12.006. Epub 2009 Mar 17.).

We agree, that “best outcomes can be expected from high volume centres where the stuff can practice advanced algorithms 24 h per day, 7 days per week, and collect their data for systematic review” (Suzuki T, Smith WR, Moore EE. Pelvic packing or angiography: competitive or complementary? Injury. 2009 Apr;40(4):343-53. doi: 10.1016/j.injury.2008.12.006. Epub 2009 Mar 17.). We collected our data as suggested by Suzuki et al. (Suzuki T, Smith WR, Moore EE. Pelvic packing or angiography: competitive or complementary? Injury. 2009 Apr;40(4):343-53. doi: 10.1016/j.injury.2008.12.006. Epub 2009 Mar 17.), as proposed by in their review article, published in “Injury”, 2009. In the mentioned review, mortality rates as high as 88.9% have been reported after angiographic embolization (Evers BM, Cryer HM, Miller FB. Pelvic fracture hemorrhage. Priorities in management. Arch Surg. 1989 Apr;124(4):422-4), and the average being 50%, referencing the following literature:


Patients requiring blood transfusions could be regarded as hemodynamically unstable, as concluded in Item #2-5. This proportion is underestimated, because not all fluid resuscitation attempts have been recorded adequately (page 12, line 20 – line 22). Patients with pelvic fractures being hemodynamic unstable, have a mortality rate of 40% - 60% (Suzuki T, Smith WR, Moore EE. Pelvic packing or angiography: competitive or complementary? Injury. 2009 Apr;40(4):343-53. doi: 10.1016/j.injury.2008.12.006. Epub 2009 Mar 17.). The outcome of the patients in our series is way better. This is due to a 24h availability of highly experienced interventional radiology staff, in a tertiary care trauma centre with high volume, as postulated by Suzuki et al.

This argumentation has been included in part into the manuscript, and can be found on page 16, line 5 – line 7.

Moreover, the conclusions drawn from the manuscript are drawn without a control group, and can be drawn from a control group, for example the fact that operations before angioembolization are a strong predictor of redo-embolization, concluding that the embolization should be performed as soon as possible. Not publishing data which are so positive meant a strong bias against the angioembolization, and would be unethical.

There is no (randomized) controlled trial published to date, and there is no study available comparing both measures directly. This statement has been included into the manuscript as well.

However, our study is the first in which a propensity score matching (PSM) was attempted in order to simulate a matched pairs analysis between deceased and surviving patients, patients with and without re-do angiography, and patients with and without surgery before angiography, concluding that transfusions received and microcoils used are strong predictors of outcome regarding survival.

Our conclusion is, that latent bleeding, which is a presumed predictor of poor outcome (Suzuki T, Smith WR, Moore EE. Pelvic packing or angiography: competitive or complementary? Injury. 2009 Apr;40(4):343-53. doi: 10.1016/j.injury.2008.12.006. Epub 2009 Mar 17.), can be prevented using microcoils. We inserted this into the manuscript as well, on page 15, line 25 – line 26.

These new insights have never been publically presented before, and can be drawn from our data with great certainty.

On the other hand, we do agree of course agree that our study has no control group. This is correct and has been included into the limitation section of the manuscript as well, to be found in the discussion part on page 13, line 14.

Item #2-9
Why was the radiological intervention method chosen in the individual cases? Was it personal choice or was it a surgical treatment failure?

It was neither personal choice nor surgical treatment failure, but a systematic approach to pelvic injuries in our reference centre. This has been clarified in the manuscript, “Materials and Methods” section on page 5, line 20 – line 16 and page 6, line 1 – 5. Therefore, the current series of patients is unique and indicating a very positive outcome of this approach.

The method of radiological intervention is not a homogenous approach, nor always consisting of the same measures. These differences allowed for the present analysis, and enabled us to draw the present conclusions.

Item #2-10

Were there differences in management strategies within the 2 age groups (younger patients aged around 45 years and older patient management peaked around 70 years)?

No, there were no differences in management strategies among any patient groups. Therefore, no conclusions can be drawn from different strategies. We clarified this on page 6, line 4 – line 5. However, this fact enabled us for performing the regression analyses and the propensity score matching (PSM).

Item #2-11

The hypothesis of the paper needs to be revised and properly set out before trying to argue or support any management by the radiological team.

Done as requested.

We agree with the Reviewer, that no clear hypothesis was stated in the manuscript.

As we are an interdisciplinary team, we our hypothesis was to identify issues in interdisciplinary patient care with potentially negative impact. We do agree that this is difficult approach and omitted this part from the manuscript in order to comply with the reviewer’s suggestions. We tried to carefully formulate the revised hypothesis (different endovascular techniques and materials used, such as i.e. the application of microcatheters together with microcoils vs. the application of macrocoils without microcatheters could affect the outcome). In accordance with this hypothesis, we reworded the aim of this study to assess the materials and endovascular techniques with regard to morbidity and mortality. This can be found on page 3, line 3 – 4 and on page 5, line 2 – line 3.

Item #2-12

It is important to include the surgical/trauma point of view within the management algorithm, as these doctors are the lead clinicians in all of these trauma patients.
We do fully agree with the Reviewer.

Trauma surgeons are of course the lead clinicians primary responsible for any trauma patient. However, neither the significance of anaesthesiology nor emergency doctors can be disputed. Surgery cannot be done without them and their work is the prerequisite for all what comes later. Therefore, the decisions are made as team, led by the trauma surgeons as well as by the anaesthesiologists – but not by the radiologists.

In our clinic, all decisions were made by this team, consisting of anaesthesiologists and trauma surgeons. In the emergency room, representatives of additional disciplines such as neuro-, visceral- and thoracic surgeons as well as radiologists are on call 24/7 as necessary. If an arterial extravasation of the pelvis is detected in the emergency CT scan, an angio-embolization is requested by the trauma surgeon and the patient is referred to the interventional radiologist. In the all cases where embolization was requested, this decision was made jointly by the surgeon, and the anaesthesiologist. In order to address the concerns raised by the Reviewer, we clarified the management algorithm in the “Materials and Methods” section of the manuscript, which can be found on page 5, line 20 – line 26 and page 6, line 1 – 5.