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Discussions

Dr. Louis Britt (Memphis, Tennessee): Dr. Rhodes has done an outstanding job, not only in analyzing these patients but also in presenting this unbelievable mass of data. I think you are to be congratulated on your mortality rate of 7%, which is about one half that reported by Drs. Fabian and Fox from our institution.

I am uncertain about the cause of this. We think this discrepancy is either because you are better doctors or there is a problem in our classification. Would you define what you consider an open pelvic fracture? Because 43% of our pelvic fractures were open; therefore the bleeding, and so forth, was into other areas.

Second I certainly agree, and it has been our experience that most deaths have been due to associated injuries. You stated in your conclusions that the major hemorrhage comes from named arteries. You only had three named arteries embolized in 9 of 239 patients arteriogramed. I think this leads us to the issue that we have all talked a great deal about: arterial embolization and pelvic angiography.

I wonder if you could tell me what the place of this is, not only in the diagnosis but also in the treatment of these patients. Sometimes we get involved with the technology and our good sense gets away from us.

Finally we have found something that we think is very significant in the last couple of years, and that is external fixation. We believe this has reduced the pelvic hemorrhage.

One of the most important things Dr. Rhodes has done, in addition to a lot of hard work, is that he has stressed that the pelvic fracture does not kill patients; rather it is the associated injuries that cause deaths. And when patients are in shock we should look outside the pelvis for another source of hemorrhage.

Dr. Anthony Meyer (Chapel Hill, North Carolina): I would like to congratulate the authors on an excellent paper and the use of multivariate analysis to try to identify the factors that contribute to survival from pelvic fractures.

I have three questions. First what criteria did you use for arteriography: absolute blood loss, rate of transfusions, or any evidence of hemodynamic instability?

Second did you have any protocols for either the evaluation, such as using abdominal or pelvic computed tomography or treatment, such as when you would use external fixation?

Third what was the frequency of severe coagulopathy or profound hypothermia in your series overall? Because these are, obviously, contributing factors in these patients, as you mentioned, on whom did you perform arteriography?

One of the things that struck me the most was the fact that only one of those patients was wearing a seat belt, which might prompt some question as to the value of seat belts for vehicular passengers.

Dr. Lewis Flint (New Orleans, Louisiana): Let me preface my questions by stating that on two previous occasions we presented data concerning pelvic fractures to this group. The last time was this past year. And in both of those presentations, we stressed the use of a multimodality evaluation approach that identified in priority those sites of bleeding outside the pelvis, followed by the injuries that are common to the genitourinary system, then the pelvic bleeding.

In your manuscript, it implies, at least, that you took a different approach, in that you tried to identify the pelvic bleeding site before you identified the extrapelvic bleeding sites.

We think that may be the wrong order in which to do things, and I wonder if the coagulopathy that you implied was a contributor to the pelvic hemorrhage in some of your patients may have been encountered because of delay in dealing with the extrapelvic bleeding sites.

I'm not quite sure—maybe you can clarify for me—what is the bottom-line message of your paper. If it is that we need to have a highly disciplined approach to these injuries and that extrapelvic bleeding sites are important determinants of the outcome, then I agree with you completely.

But if your thesis is that the site of the bleeding in the pelvis is not important a factor in the outcome of these injuries, then we have some grounds for disagreement. Perhaps you could clarify that in your closing.

Dr. Galen V. Poole (Closing discussion): Dr. Britt, I do not think that the difference in mortality rate has anything to do with the quality of the physicians. To some extent it may be because we were very vigorous in identifying all patients with pelvic fractures, even those with fairly minor injuries to the pubic rami and things of that nature, which may not have been coded in your own series or those of others or may not have been included although they were identified. We may have had a larger proportion of relatively minor injuries that would not be associated with significant injuries to nonpelvic sites.

An open fracture, by our definition, was one that involved the overlying skin, the rectum, or the vagina. We did not include those that involved the bladder or other areas of the genitourinary system because, in most circumstances, those areas would be sterile. There would be very little contamination that would involve them, and patients were not likely to have a greater incidence of death from pelvic hemorrhage if they had an injury to the bladder compared to those with other closed fractures.

You asked what the role of hemorrhage was and how we identified the patients who would have arteriography.

If a patient seemed to be bleeding to death, had no blood in the chest, no external sites of hemorrhage from extremities, a negative lavage or lavage that was positive only by counts, then that was a patient who probably was bleeding into the pelvis.

This is not new information, and we are not trying to present anything revolutionary. We are re-emphasizing the importance of what will cause death in these patients.

You did mention the use of external fixation. We have used external fixation for a number of years. Our orthopedic surgeons are, in general, very keen on the use of external fixation to improve stability and slow bleeding. In all honesty, I have no data to suggest that this may be effective, and it may even be true that it has no effect or only a minimal effect, especially in patients whose bleeding is arising from large arteries.

Dr. Meyer asked what criteria we used for arteriography, and I hope that I have clarified that in my answer to Dr. Britt's question. If there is no evidence of nonpelvic hemorrhage and the patient appears to be bleeding to death or is in significant hemorrhagic shock, those patients need an arteriogram. And I am not sure that an external fixator will help them; not if they are bleeding from the pudendal artery or a gluteal or one of the other major vessels in the pelvis.

External fixation was used primarily when it appeared that the pelvic fracture was grossly unstable mechanically. There was no other protocol or criteria that we used to select external fixation, but it was used fairly frequently.

The overall incidence of coagulopathy in the entire series was about 5% to 6%. These patients were usually the ones who were more seriously injured and had lost significant volumes of blood, but the blood may not have been lost into the pelvis. It was often from nonpelvic sites. And when they developed hemorrhagic shock with poor tissue perfusion, they clearly developed coagulopathy because of hypothermia and the replacement of blood with asanguinous fluids as well as banked blood.

Dr. Meyer also mentioned that only one of those patients was wearing a seat belt. I would remind the audience that the state of Mississippi has the lowest percentage of seat belt use of any state in the union, only 17%. This is a problem that we deal with every day, unfortunately.

In answer to Dr. Flint's questions, I do not think we really disagree. I think we have just used a slightly different approach. We also stressed a multimodality approach in these patients. And although he may have thought that we were looking for pelvic hemorrhage before we looked for other sites of hemorrhage, that is really not the case.

There were three patients in whom there were protocol violations, although these were not done under strict protocol; it was more of a commonsense judgment. But these three patients were taken to the arteriogram suite, had arteriography, had no sites of pelvic hemorrhage, and then someone decided that perhaps we should have done a lavage earlier. Those were clearly errors on our part in management. They occurred in the heat of battle, often with some inexperienced residents who may not have been communicating as well as they should have. But, in general, patients were evaluated with lavage or computed tomographic scanning to address abdominal hemorrhage before any pelvic sites were evaluated.

The bottom line is simply that you cannot ignore the abdomen as a site of major hemorrhage. You cannot ignore the chest or the importance of head injuries in these patients, who are usually injured in motor vehicle accidents or by other blunt forces with which they are very likely to have injuries outside of the pelvis, which really determines their outcome.