Considering surgical invasiveness

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June 2016

Let's consider accident surgery as an obvious example of surgical invasiveness: Accident and surgery produce a variable amount of tissue trauma that reduces resistance to infection and impairs fracture healing. Reducing surgical invasiveness is therefore a primary goal concerning equally, the surgical approach and the handling for reduction and stabilization.

The use of external fixators was an early example of reduced surgical invasiveness. The advantages provided by intra-operative visualization techniques (fluoroscopy or endoscopy) are obvious in optically assisted gallbladder and menisci resections where the tissue trauma due to the approach is minimized. The revolution of so-called "minimally invasive surgery" is still ongoing and has touched every surgical specialty.
We focus here on accident surgery.

In traumatology, a surgical procedure produces additional tissue damage *(surgical invasiveness)* to be added to the *tissue trauma caused by the accident*. The sum of both should not exceed the tolerance of the affected tissue that would lead to definitive tissue damage (necrosis, infection). This is relevant for decision making, balancing different treatment options and the timing thereof. It goes without saying that the size of the surgical wound is fairly irrelevant as underneath a very small wound, large tissue damage may be produced due more demanding navigation in a confined space.

To improve the outcome, it would be a prerequisite to measure the amount of tissue damage related to defined actions. Unfortunately, up to now there are no accepted techniques to adequately quantify the amount of tissue trauma. Research is ongoing in order to find corresponding markers (further reading references: 1, 2, 3, 6). Until such markers are available, complete image documentation of surgical procedures, amenable to retrospective analysis such as ICUC®[1] provides, adds biological information to X-ray and thus allows a more objective estimate of invasiveness.

For mechanical reasons IM nailing is the treatment of choice for shaft fractures. Only short skin incisions are needed for nail placement, but important tissue damage can result from manipulating through small incisions. Furthermore, we know that the simple introduction of a guide wire for IM nailing produces an important increase of the intramedullary pressure and a biochemical cascade. (further reading references: 5). X-rays and length of incision do not provide information about surgical trauma. X-rays alone provide mainly mechanical information. A comparison of the additional trauma caused by nail insertion or by a plate inserted by minimally invasive techniques (Fig. 1 and Fig. 2) to stabilize a fracture is therefore not possible. Until markers are available, a retrospective analysis of complete image documentation of the technical procedure, can help to improve the comparison by better estimating the surgical invasiveness (tissue trauma to be added to the trauma of the injury itself). This should be carried out in every case.

Analyzing images of the technical procedure is still not quantification, but, not to rely only on the mechanical information of X-rays, is a significant step forward.

At any rate, the length of the skin incision is not a parameter for invasiveness.

1 ICUC® records close up the surgical activities and thus provides information, which allows the surgeon to judge biology, for instance when the recordings show intermediate full devascularisation of a bone fragment. Such information is not available on X-rays.

Fig. 1 Radiological course of a nailed transverse fracture of tibia and fibula. *The X-rays alone do not allow an estimate of the surgical trauma produced by the insertion of the nail. A comparison of surgical invasiveness with the case of* ***Fig. 2.*** *is not possible. An estimate is possible by scrolling through the respective images of both procedures included in the ICUC® App. 142 images are available for this case and 98 for the case of* ***Fig 2****.* ICUC® App ID 42-SI-351

Fig. 2 Radiological course of tibia fracture plating. *Clearly, this case could also have been treated conservatively. Again, the surgical trauma cannot be estimated if only X-rays are available. Scrolling through the 98 images of the procedure included in the ICUC® app gives additional information about the surgical invasiveness and might allow a comparison with the case of* ***Fig.1****.* ICUC® App ID: 42-WE-608

Minimally Invasive Osteosynthesis (MIO) (further reading references: 4) aims at leaving "small foot prints" of the surgery with a goal of improving biology by reducing invasiveness of the access. MIO can provide an additional advantage if the following, generally accepted rules and goals are observed :

- Anatomic reduction and stable fixation of articular fractures.
- Optimal reduction of length, rotation and axis for shaft fractures.
- Careful soft tissue handling, especially avoiding excessive traction on soft tissues.

The advantages of MIO need to be balanced against the increased risks of nerve and vessel injury. Timing of the operation must take into account an eventual possible need to convert MIO to open surgery. The latter requires MIO surgeons also experienced in open techniques, in order to achieve the aforementioned goals. The experienced surgeon is also in a position to manage effectively unexpected events, rather than insisting on MIO with a potential risk to the patient.

Conclusion:

Reducing surgical invasiveness is an important goal. ICUC® contributes biological information that supplements the mainly mechanical information of X-rays. Minimally Invasive Osteosynthesis aims at reducing invasiveness but requires careful balancing of the risks and advantages.

For further Reading:

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