

Ergonomics in Minimally Invasive Surgery

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Editorial

Minimally Invasive Surgical (MIS) procedures reduce infection risk, cause less post-operative pain and discomfort, result in shorter hospital stay and provide better cosmetic results with less scarring. Superior short term clinical and economic outcomes of MIS over traditional open surgery were previously demonstrated for several procedures [1,2]. It is expected that in near future MIS procedures will prevail open surgeries when possible and the access of patients to this therapy and technology will be broadened globally.

However, MIS is also more demanding for the surgeon. This may be partially attributed to additional complex devices and difficult interfaces placed between the patient and the surgeon. Safety, efficiency, and comfort of the operating team and, by consequence, clinical outcome of the patient may be significantly improved with appropriate ergonomics of the operating room (OR) environment [3]. The user may even experience injury or disease due to inadequate OR ergonomics as previously reported for thenar neuropathy [4], pressure related chronic pain [5], carpal tunnel syndrome, eyestrain and cervical spondylosis [6] among the others. The effects of inappropriate OR ergonomics may be manifested as well on patients experiencing e.g. greater postoperative pain at port sites.

One of the most important differences between open and laparoscopic surgery consists in limited degrees of freedom and disconnection of the visual and motor axes. Open surgery is characterized by three-dimensional spatial field of vision and haptic, tactile feedback; features we are naturally used to. In laparoscopy, visual field is reduced to two dimensions of the screen associated with loss of depth and strongly limited in space. Tactile feedback practically disappears; long instruments manipulated through the access ports reduce the efficiency and increase the time of the dissection [7]. Working in separate coordinate systems requires more concentration. It potentially results in more static posture during major part of the procedure which may lead to fatigue and contribute to the inefficiency and/or errors.

Laparoscopic instruments are usually available in one standard size. They also transmit lower force compared to standard instruments requiring more effort of the surgeon [8]. This can be currently overcome by using powered instruments even though they are more expensive and currently limited to staplers. New cutting edge technologies combining medical imaging with virtual and/or augmented reality and computational simulations start to appear on the market. Robotically-assisted surgery finds its place in more and more surgical procedures.

Today, any additional expense has to be justified with medical evidence. Current evidence does not seem to be always sufficient to

justify additional cost related to ergonomics of medical devices not only limited to MIS. Standard scalpel has awkward ergonomics; its handle could be more pen-like to ensure better grip and higher accuracy of surgical maneuvers. Articulated laparoscopic instruments could be considered too expensive compared to standard once without strong evidence showing their superiority in terms of clinical outcome. The author of this editorial was witness of a situation in which a surgeon asked his assistant for linear articulated stapler during a colorectal surgery. He was told that no such instrument was available and the hospital stopped buying them because of the cost.

The progress in this domain does not only depend on the manufacturers constantly trying to reduce the cost while under pressure of the shareholders willing to increase the benefits. It also depends on governments and reimbursement systems, registration authorities, buyers at hospitals and clinics, surgeons themselves and actually the entire chain from a new innovating idea to the final client. In current extremely dynamic and complex environment of healthcare, it will require even more interaction and discussion among the players with client-patient-on the first place.

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