

Pain distraction during awake low anterior resection and Cuddle Delivery initiative for inpatient: frugal procedural options to support surgery in the COVID-19 era

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Abstract. – OBJECTIVE: Since minimally invasive surgery and general anesthesia are both aerosol-generating procedures, their use became controversial during the outbreak of coronavirus disease 2019 (COVID-19). Moreover, social distancing resulted in serious psychological consequences for inpatients. This case report investigates pain distraction during awake laparotomy, as well as new possibilities for emotional postoperative support to inpatients.

PATIENTS AND METHODS: A 72-year-old man affected by middle rectal adenocarcinoma underwent lower anterior resection plus total mesorectal excision under combined spinal-epidural anesthesia. A 3D mobile theatre (3DMT) was intraoperatively used for pain distraction. A postoperative "Cuddle delivery" service was instituted: video-messages from relatives and close friends were delivered daily to the patient through the 3DMT. Emotional correlations were investigated through a clinical interview by the psychologist of our Hospital.

RESULTS: Intraoperative, as well as postoperative pain, resulted well-controlled: visual analogue scale (VAS) ≤ 3 . Conversion to general anesthesia and postoperative intensive support/monitoring were unnecessary. The "Cuddle delivery" initiative positively fed our patient's mood and attitude, strengthening his bond to life.

CONCLUSIONS: During pandemic, awake laparotomy under loco-regional anesthesia may be a crucial option in delivering acute care surgery to selected patients when intensive care beds are unavailable. Our procedure introduces potential ways to optimize this approach.

Key Words:

Awake surgery, Pain distraction, Loco-regional anesthesia, Neuraxial anesthesia, Surgical oncology, COVID-19.

Introduction

During coronavirus disease 2019 (COVID-19) pandemic the demand for critical care beds among the medical services has rapidly exceeded its supply and this put almost all healthcare systems to the test. Elective surgery has been drastically limited. After lockdown, innovative COVID-19 preoperative triage protocols allowed to gradually reopen and ramp-up elective surgeries. Nevertheless, ICUs remained far from being COVID-free for a long time and this restricted the surgical strategies.

Major abdominal surgeries are generally carried out with minimally invasive surgery (MIS) under general anesthesia (GA). Since MIS and GA are both aerosol-generating medical procedures (AGMP), their use became controversial during pandemic^{1,2}.

Besides the risk of contamination inside the operating theatres, frail patients may be affected by GA which can be associated with delayed recovery after anesthesia and can lead to the admission of the patient to the ICU³. At a time of scarce resources, this was prohibitive.

In such a peculiar context, performing open abdominal surgery under loco-regional anesthesia (LA) helped us to deliver acute care surgery to selected patients in the COVID-19 era. During LA (spinal, epidural or combined spinal-epidural), anesthetic agents are administered by lumbar injection in the spinal and/or epidural space. This approach reduces exposure to patients' respiratory secretions, the risk of perioperative viral transmission and preserves patients' cardiorespiratory function. On the other hand, analgesia represents

a relevant issue during awake surgery. Of course, patients are continuously monitored, but anxiety, fear, discomfort and pain sometimes become intolerable and require sedation or conversion to GA.

In the recent past, the use of different electronic devices for pain distraction during ambulatory surgery or minimally invasive procedures has been described⁴⁻⁷. We then wondered if pain distraction through the use of a 3D mobile theatre (3DMT) may have the same role also during major abdominal surgeries.

Lastly, since containment measures and social distancing have been imposed, these resulted in serious consequences for our inpatients: the impossibility to be visited by their loved ones (sometimes for more than one week), visibly increased the sense of solitude, discouragement, depression of almost all our inpatients, especially the elderly. This negatively influenced postoperative course. We hypothesized that instituting a "Cuddle Delivery" service through which relatives and friends could send video-messages to the inpatients would have contributed to fill the emotional gap related to the strict containment measures inside the Hospital.

The aim of this study is to investigate pain distraction as a potential option to enrich the awake approach for major abdominal surgeries, and to report a functional countermeasure to social distancing in support of inpatients.

Case Report

A 72-year-old man affected by middle rectal adenocarcinoma, waiting for post-neoadjuvant abdominal surgery, was admitted to our Department in October 2020.

Both surgical procedure and anaesthesiologic approach were explained to the patient one week in advance, on the day of pre-admission tests. On that occasion, the patient underwent nasopharyngeal swab for COVID-19 diagnosis (resulted negative) and the 3DMT was illustrated to the patient who became familiar with the device, wore it and expressed his approval for its use during surgery under full informed consent.

Awake Laparotomy

Surgery was performed under combined spinal-epidural (CSE) anaesthesia. The site of lumbar puncture was the L2-L3 interspace. A bolus of Hyperbaric Bupivacaine 5 mg/ml (12 mg) and Morphine Sulfate 10 mg/ml (150 mcg) solution has been injected into the subarachnoid space.

The use of a catheter-through-needle set allowed to insert a polyamide catheter in the epidural space. The catheter was then connected to an elastomeric pump filled with a solution of sterile water (192 ml), Ropivacaine (200 mg) and Morphine sulphate (6 mg), on the basis of patient's age, height and constitution. Infusion speed was set on 4 ml/hour.

Low anterior resection (LAR) plus total mesorectal excision (TME), followed by colorectal transanal end-to-end anastomosis, without temporary diverting ileostomy, were performed. Operating time was of 140 minutes.

Vital signs, intraoperative pain intensity, ergonomic comfort/discomfort level, sense of presence and distress were continuously monitored. Only light sedation was performed (Midazolam 5 mg). No other drugs were administered to the patient during surgery. Intraoperative pain, assessed through visual analogue scale (VAS), resulted well-controlled ($VAS \leq 3$) and conversion to GA was unnecessary.

Postoperative pain was daily assessed through VAS resulting always well-controlled ($VAS \leq 3$). Postoperative intensive monitoring/support was unnecessary. A distinct COVID-free ward had been set up for postoperative recovery to keep COVID-negative patients separated from all other patients. Epidural elastomeric pump was removed on postoperative day (POD) 3. The patient was discharged free of complications on POD 4. Histological staging was ypT3N1c (Tumor Regression Score after radiotherapy: 3)⁸.

3D Mobile Theatre

During surgery patients wore Royole's Moon (RM) (Royole®, Shenzhen, China). RM is an all-in-one 3DMT headset. It uses two AMOLED displays that deliver 3D or 2D content in Full HD 1080p resolution. The displays deliver 3000 pixels per inch (PPI) and a blistering fast image response rate of 0.01 ms. The display angle is 10° below horizontal. Optics are independent so that they can be adjusted from -7.0 D to +2.0 D. An immersion mask is mounted on the device for enclosed eye fitting. Active noise cancellation is incorporated. The right ear pad incorporates flexible sensor technology to navigate the menu and to adjust volume by swiping or tapping a finger on it.

The internal flash storage allowed storing several 4K ultra-HD videos. Some videos offered an aerial ambient nature experience (Fiji Islands, Hawaii, Havasupai Falls trail, Redwood National

Park), other videos simulated a walk through a specific scenario (Manhattan, Rome, Vatican Museums). The length of each video was one hour.

After positioning on the operating table, the patient's right arm was left free so that the patient was able to self-adjust the device in case of displacement. The patient wore the 3DMT two times during surgery. The first time started before surgical incision, for 57 minutes. After a pause of 50 minutes, he wore the 3DMT again, this time for 35 minutes (Figure 1).

A questionnaire related to the intraoperative use of the 3DMT was designed to investigate possible critical aspects which may have had any effects on our patient, before, during or after the use of the device. The evaluation sheet was divided into 3 sections:

- "First impression" (weight of the device, ease to wear the device, comfort, ease to focus, video and audio quality, overall ease of use)
- "While watching" (sense of constriction, discomfort, pain, steadiness of the device on the face)
- "At removal" (weight of the device, discomfort, pain, eye strain, eye dryness, headache, dizziness, nausea, tinnitus).

For every single aspect (positive or negative), the patient was asked to express his personal evaluation from 1 (totally bad evaluation, or absence of the sensation in question) to 10 (totally

good evaluation, or presence of the sensation in question). Marks were interpreted oppositely on the basis of the nature of the aspect in question: marks from 1 to 4 were considered indicators of a negative impression if related to positive aspects (on the opposite, they represented a positive impression in case of negative aspects). Marks from 5 to 6 were considered indicators of neutral impression. Marks from 7 to 10 were considered indicators of positive impression if related to positive aspects (of negative impression in case of negative aspects).

The questionnaire was filled out by the patient before discharge. Its analysis revealed that, despite initially discouraged by the weight of the device and hesitant during the first focusing, after proper training, the patient did not encounter any difficulties in its use, nor discomfort while wearing it or after removal.

Cuddle Delivery Initiative

Before admission, we contacted the wife of our patient and gave her the opportunity to send us some home-made cheering videos addressed to her loved one. The same opportunity was opened to his relatives and close friends. The video-messages were daily delivered to the patient through RM during his postoperative stay (Figure 2). The day before being discharged, the patient underwent clinical interview by the psychologist of our Department. The interview revealed that the patient did appreciate the initiative, reporting it helped to reduce the sense of loneliness and fed the desire to come back home soon. The patient also reported that the Cuddle Delivery initiative (Figure 3) distracted him from physical pain.

Discussion

Major operations in General Surgery are often carried out through MIS under GA. LA is basically reserved to minor surgical procedures belonging to day-surgery protocols. However, since COVID-19 outbreak began, MIS and GA had been under great debate as they are both AGMPs and could contribute to spread contamination inside operating theatres. Pneumoperitoneum creation/exsufflation and electrical/ultrasonic devices' smokes put healthcare operators at potential risk and initial reports advised against their use⁹.

Since multiple authors already described awake laparotomy as feasible and safe for major



Figure 1. Intraoperative use of the device.

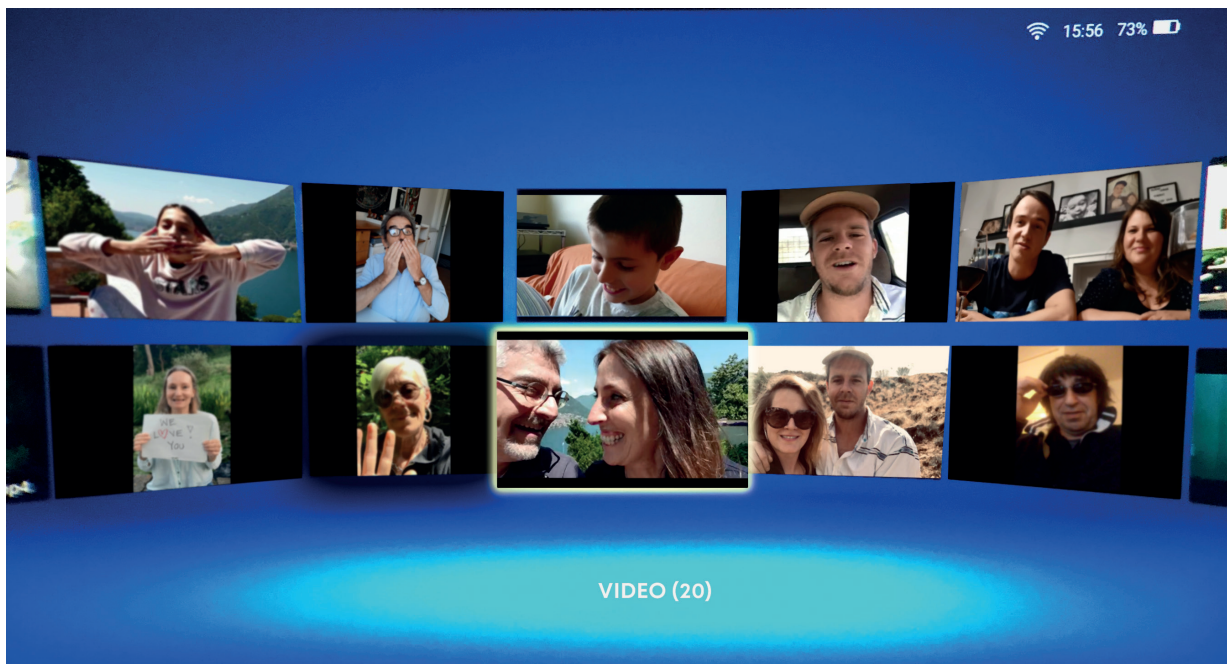


Figure 2. Patient's point of view while receiving personal "postcards" from relatives and friends through the 3DMT.

surgical procedures, this solution has been considered a valid option to reopen surgery after its recent halt¹⁰⁻¹⁴. A recent narrative review¹⁵ aims that laparoscopy does not, in itself and with the proper precautions, increase the risk of airborne transmission. Nevertheless, the Authors themselves, concluded that evidence-based research in this field are urgently needed and that "precautionary principle" should be adopted as long

as uncertainty of surgical smoke or aerosol virulence of SARS Cov-2 exists. The identification of SARS-CoV-2 in peritoneal fluid of COVID-19 patients was recently reported and probably bolster the mentioned "precautionary principle" which should still be adopted¹⁶.

Awake laparotomy may allow performing abdominal undelayable surgeries, despite the unavailability of ICU beds, resulting feasible, safe and painless¹⁷. In our recent experience, the "awake approach" allowed delivering undeferrable acute care surgery limiting the risk of contagion inside theatres¹⁸. Nevertheless, although this approach did not entail a relevant elongation of the operative time and intraoperative pain was always well-controlled, it may cause discomfort to the patient who becomes intolerant to long procedures. The awake patient constantly hears and sees what happens inside the operating room around him. During long procedures this can make the patient upset, especially if intraoperative complication occurs.

The use of head-mounted displays or portable virtual reality (VR) devices in medicine, surgery and behavioral healthcare is not new. Multiple authors previously described the successful use of VR and interactive simulation for pain distraction during burn wound debridement, upper gastrointestinal endoscopies, operative gynaecological endoscopies, dental procedures, ambulatory sur-



Figure 3. Cuddle Delivery initiative logo.

gery (lipoma resection) or minimally invasive cardiac surgery^{4,7}. In all cases head-mounted displays without earphones were used. Some of these authors only hypothesized the use of highly immersive devices during prolonged and more invasive surgeries⁷.

To the best of our knowledge, this is the first report of pain distraction through the use of an immersive audio-visual device during a major abdominal awake surgery.

Several 3DMT are available in commerce. We selected this specific device because of some peculiarities. First, RM is an all-in-one headset. Looking for a combined audio-visual experience, we believed this aspect would have revealed to be critical if immediate anaesthesiologic support during surgery required the quick removal of the device. Second, other popular head-mounted devices come with an elastic band to be fastened on the back of the head. This could have been a source of discomfort during a prolonged surgery requiring continuous supine position. Third, independent optics allow avoiding prescription glasses while watching so that it can be used even by a patient affected with different mild optical defects.

During the pre-admission visit the intuitive interface of the operating system and ear pad touch control system required only a brief illustration to the patient who quickly learned how to self-adjust the device.

Intraoperatively, RM's giant full HD curved screen helped in delivering the compelling stereoscopic depth perception capable of creating the immersive experience we needed. Noise-cancelling headphones eliminated all operating room distracting sounds while the immersion mask blocked out the ambient light making the patient believe he was truly somewhere else. Optimized viewing angle and the combination of ultra-high-resolution pictures with fast image response rate contributed to provide a relaxed prolonged watching, reducing eye strain. The ergonomic design ensured a comfortable fit. The device was well-tolerated by the patient who never complained about sense of constriction or breathing limitations.

Additionally, we believe our approach represents an example of positive technology^{19,20}. On the basis of our experience, 3DMT use as a countermeasure to social distancing inside the Hospital looks promising. During the pandemic, several elderly patients underwent acute care surgery for intestinal obstruction or gastroin-

testinal bleeding at our Department. Seniors, who often come from long-term care homes or retirement homes, are unlikely to adapt to new equilibriums, and it is well known that old patients affected with mental dementia can develop postoperative confusion, disorientation, depression and fear. Briefly, the stress related to Hospital stay can turn into mental and physical decline. After social distancing limitations we noticed that this postoperative psychological issue occurred also in the elderly without mental decay and in younger patients. Undergoing a major surgery is always a stressing circumstance but, in the time of coronavirus, extreme psychological stress already puts strain on our identity and relationships²¹. With this in background, the actual impossibility to be visited by your loved ones entails accentuated solitude and discouragement.

Although almost every patient owns a mobile phone (often a smartphone), receiving personal "postcards" through a 3DMT, made the video-messages more realistic helping our patient to perceive the love his relatives and friends wanted to deliver. This showed remarkable effects on our patient's postoperative course, positively feeding his mood and attitude, and strengthening his bond to life.

We have to disclose the limitations of this report. This is a single-centre experience, based on a single case. Nevertheless, we believe our preliminary data may allow raising valuable observations and questions. Further studies may deepen potentialities and functional peculiarities of pain distraction during awake abdominal surgeries.

Conclusions

During pandemic, open surgery under LA may be a crucial option in delivering acute care surgery when ICU beds are unavailable and postponing surgery is unacceptable. Beyond the COVID-19 era, pain distraction may turn awake surgery into a more pleasant procedure for the patient. Moreover, the use of a 3DMT can help in delivering postoperative psychological care during social distancing.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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