

# Management of a road major trauma in a spoke hospital: a report of opioid-free anesthesia in a minimally invasive orthopedic surgery

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## Abstract

Major trauma is bound to be managed in highly specialized centers. Due to logistics needs or due to an initial clinical stabilization, these patients happen to be managed in hospitals that are not fully equipped for trauma. We handled a patient, major trauma to dynamics following a high-speed collision between two cars in which she was behind the wheel. The patient was also complex due to cardiovascular and respiratory comorbidities. After 'ABCDE' and radiological evaluation, the patient was managed in our hospital with ICU recovery and multiple orthopedic interventions to which she was subjected with neuraxial and peripheral regional anesthesia. The patient was managed successfully and

with excellent pain control. The risks associated with her comorbidities were limited to a minimum and she was discharged for rehabilitation 5 days after the operations.

## Introduction

The major trauma patient requires complex management that begins at the pre-hospital level. This type of patient should undergo a territorial triage, should come to the nearest Trauma Center, should be managed according to ATLS guidelines.<sup>1</sup> Coordination and communication between pre-hospital and hospital care providers is the key to timely preparation and mobilization of resources. The 'ABCDE' of the primary survey is, in essence, a quick but complete examination to exclude injuries that are immediately life-threatening.<sup>2</sup> Despite this premise, the territorial organization is also influenced by the logistics and resource, so the Spoke hospitals receive polytrauma patients at the Emergency Department. Sometimes the resources of smaller clinics are not enough to meet the needs of these patients, who are therefore transferred to larger centers after the stabilization of vital functions. In fact, transfer must be considered early when the needs of the patient exceed the capabilities and resources of the referring institution.<sup>3</sup> This requires well-developed working relationships between hospitals with a regionalized trauma care plan.

From another point of view, due to changing demographics geriatric patients with multiple comorbidities also in the management of polytrauma patient the perspective is opening to neuraxial or peripheral regional anesthesia techniques.<sup>4,5</sup> The complex patient, especially with respiratory and/or cardiovascular comorbidities, can benefit from this type of approach.

In our hospital, the major trauma involves the activation of the trauma team which is coordinated by the anesthesiologist. When vital signs and wound balance are assessed, a decision is made whether to treat the patient in-house or if a transfer is required. Even the movement of the patient who has suffered a major trauma is the responsibility of the anesthetist.

Aim of this report is to illustrate a case in which it was possible to manage a polytrauma in a spoke hospital despite the complexity of the patient's basic conditions, with some necessary precautions and with collaboration between different specialist figures. The patient was managed with a totally opioid free anesthetic approach, with combined techniques of neuraxial and peripheral regional anesthesia.

## Case Report

We received a 74-year-old female patient, BMI 23.5, in our Emergency Room (ER) following a car accident (the patient was sitting in the driver's seat) from a collision of two vehicles on high-

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Patient consent for publication: the patient gave her written consent to use her personal data for the publication of this case report and any accompanying images.

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speed road, therefore it was a major trauma by dynamic criteria.<sup>1,6</sup> She was admitted to the ER without neurological impairment (GCS 15), reporting wearing seat belt and denied head trauma. The vital functions were ascertained, FAST-ECHO was performed (thoracic, cardiac, abdominal and pelvic ultrasound windows were explored) which excluded lesions of parenchymatous organs; then the patient performed a total-body CT scan that showed no ongoing bleeding and thoracic contusion with four rib fractures on the left side determining a flail chest without pneumothorax nor emothorax; there was no active bleeding into the pelvis. X-rays of the limbs was performed and showed a fracture of the distal third of the left femur (33 A 3 sec. AO/OTA), basi-cervical fracture of the right proximal femur (31 B 3 sec. AO/OTA), oblique fracture of the middle third ulna (2U2 A 2 sec. AO/OTA) and right bifocal radius fracture (2R2 C 2 sec. AO/OTA) (Figure 1).<sup>7</sup> The Abbreviated Injury Scale (AIS) identified this trauma as a severe one with the Injury Severity Score (ISS) of 18 points.<sup>8</sup> The patient received intravenous therapy with 1 gram of tranexamic acid in the shock room, which was then continued every eight hours in the ICU until the day after surgery.

In her medical history the patient reported severe aortic insufficiency with biological prosthesis implantation, chronic atrial fibrillation, moderate COPD, oral therapy with Rivaroxaban which was suspended 24 hours prior to surgery as per guidelines. The patient had undergone left hip replacement the previous year, but the undersized stem subsided. This resulted in severe impairment of left hip movements, but the patient was still able to walk, drive and carry out normal activities of the daily living. She was also affected by high grade right hip osteoarthritis (Tonnis 2).<sup>9</sup> In the shock room a blood gas in ambient air was performed that showed:  $\text{paO}_2$  56 mmHg, pH 7.35,  $\text{pCO}_2$  51 mmHg. This mild hypoxia was consistent with previous COPD and multiple rib fractures.

After the lesion balance, in accordance with local protocols, it was considered possible and appropriate to manage the patient at the Spoke hospital.

Due to its general complexity, the patient was admitted to the ICU, where she practiced oxygen therapy with nasal goggles (5 liters per minute). Chest CT scan images confirmed COPD findings. On her blood gases in ICU, the patient had a  $\text{PaO}_2/\text{FiO}_2$  ratio below 200, however she was eupneic and maintained a  $\text{paO}_2$  over 70 mmHg. There was always mild hypercapnia ( $\text{pCO}_2$  about 50 mmHg) consistent with COPD. The patient complained mainly of chest pain due to multiple rib fractures. As soon as she arrived in

the ICU, it was therefore decided to practice an analgesic monolateral ESP-block on the left side. The chest wall block was performed placing the patient on the right side, in sterile and ultrasound guided way, with parasagittal scan and out-of-plane approach. Ropivacaine 0.5% 20 mL was injected to the transverse processes of T4 and T6 of the left dorsal vertebrae. NRS declared by the patient decreased from 7 to 2 in 60 minutes. A mild sedation with dexmedetomidine was decided upon to prevent ICU-associated delirium and promote nighttime rest. because of her cardiologic history, the patient performed an echocardiogram. The estimated ejection fraction was 45% and the valve function preserved, with good functioning of the biological aortic prosthesis.

The patient presented anemia ( $\text{Hb}=7.9$  mg/dL). It was therefore decided to transfuse concentrated red blood cells in view of the surgery.

The following day the patient was operated on for the stabilization of the femoral and humeral fractures. Fractures were all treated in a single operating session. Procedures were carried out after antibiotic prophylaxis with 2g of cefazolin administered one hour before surgery. Rivaroxaban was suspended 24 hours before surgery and resumed 48 hours after it, in accordance with the ESRA guidelines<sup>10</sup> relating to neuraxial blocks in therapy with DOAC at low doses (the patient was on rivaroxaban 10 mg daily).

The patient was subjected to combined spin-epidural anesthesia in lateral position at L2/L3 level with a spin-epidural kit (spinal needle pencil point 27 gauge, Tuohy needle 18 gauge, epidural catheter 25 gauge, liquid mandrel). Spinal anesthesia was achieved with Levobupivacaine 9 mg to ensure hemodynamic stability. Two hours after the spinal injection, 20 mL of 0.125% Levobupivacaine were injected through the previously placed epidural catheter and connected PIEB pump for intermittent infusion (0.125% 20 mL every two hours). Finally, the oblique right ulna fracture and the bifocal radius one was treated using a percutaneous disto-proximal infibulum system for both the ulna and the radius. the anesthetic management of this surgical time was conducted with a peripheral regional anesthesia. A block of the brachial plexus was performed by supraclavicular route, with ultrasound guidance and a linear transducer, with Ropivacaine 0.5% 20 mL.

Fractures were all treated without the exposure of the fracture's fragments. The first surgical time involved the treatment of the left distal femur fracture, with the patient in supine position with the knee semi-flexed. The axis and rotation of the limb were restored



**Figure 1.** Oblique fracture of the middle third ulna and right bifocal radius fracture (A), fracture of the distal third of the left femur (B), basi-cervical fracture of the right proximal femur (C).

under fluoroscopic control and an osteosynthesis with a condylar plate was performed using the Minimally Invasive Plate Osteosynthesis (MIPO) technique.<sup>1,11</sup> Then, the basi-cervical fracture of the proximal right femur was treated with the lower right limb in traction, implanting a blocked short intramedullary nail. the anesthetic management of this surgical time was conducted through a neuraxial anesthesia.

Throughout the surgical time the patient remained conscious, cooperating, spontaneously breathing with oxygen support (5 liters per minute). Hemodynamics was characterized by atrial fibrillation rhythm, which the patient already had. Arterial pressure, monitored invasively, remained stable, with values above 100 mmHg of systolic and 60 mmHg of diastolic, for the entire operating time. Considering the intraoperative blood loss, estimated at 700 ml (post-operative Hb=8.5 mg/dL in a cardiopathic patient) it was decided for further transfusion of concentrated red cells. The patient was discharged from the operating room without pain (NRS=0) and calm. She was back in the ICU for postoperative monitoring.

The patient acquired the sitting position the day after the surgery and began the active mobilization of all the joints of the lower limbs, out of load. The load on the right lower limb could not be granted due to the inability to use walking aids due to the fracture of the right forearm. Active mobilization of the right wrist, hand and elbow was also immediately permitted, limiting only pronation and supination of the right forearm. A plaster immobilization of the forearm was packaged for pain relieving purposes only and was removed for mobilization and then repositioned during rest (Figure 2).

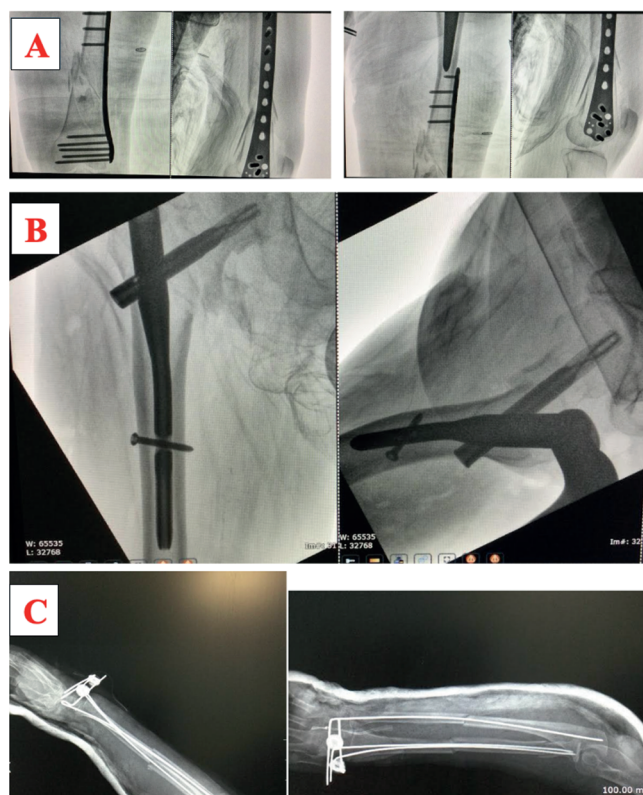
The analgesic therapy was carried out with a PIEB epidural pump for the first 24 hours. The brachial plexus block performed

in the operating room had a similar duration from the point of view of analgesic coverage. The patient reported NRS=0 for the first postoperative day. Starting from the second day, an analgesic therapy was started with acetaminophen 1000 mg iv every 8 hours. She always reported NRS<3. In the postoperative period, respecting the intervals provided by the guidelines in the case of neuraxial procedures, anticoagulant therapy was practiced with Clexane 6000 IU twice a day given the high thrombotic risk. Epidural catheter was removed 48 hours after placement, 6 hours after heparin administration. The patient was discharged to a rehabilitation facility on the fifth postoperative day. At discharge, respiratory exchanges improved with weaning from oxygen therapy, paO<sub>2</sub> in ambient air greater than 65 mmHg, PaO<sub>2</sub> /FiO<sub>2</sub> ratio in ambient air greater than 200.

## Discussion

The major trauma should be managed in the regional reference centers, but sometimes it does not happen due to resources and logistics in territorial management. This is what happened to the patient who came to our hospital. It is a spoke hospital, in which there is a radiology with a CT machine. The hospital is equipped with ICU, general surgery, orthopedics and gynecology-obstetrics. After stabilization in the emergency room and evaluation of the patient's condition, it was decided to manage the patient in our hospital rather than have her face a new ambulance transport, since the patient needed orthopedic operations and hospitalization in the ICU.

The management of pain in the trauma patient can be challenging. Resuscitation and the assessment and treatment of life-threatening injuries are always priority. However, there is increasing evidence that the pain associated with trauma is undertreated.<sup>13,14</sup> The fear of administering pain therapies, especially systemic opioids, to trauma patients arises from the idea of causing collateral damages, such as hemodynamic instability or respiratory depression and airway compromise or delirium, mostly for geriatric patients.<sup>15</sup> Based on these considerations, we decided to treat the patient's pain associated with rib fractures with a regional analgesia technique, avoiding the use of opioids from the beginning.<sup>16</sup> The choice was motivated both by the patient's age (increased risk of delirium) and by comorbidities. In fact, the patient presented cardiovascular and respiratory comorbidities as illustrated and required oxygen therapy. We performed a single-sided ESP block, as the rib fractures were all on the left. The effectiveness of the ESP block for rib fractures has already been demonstrated in the literature.<sup>17</sup> Regarding anesthetic management, we chose a multimodal analgesia based on a neuraxial technique and a peripheral regional technique. This allowed us to avoid general anesthesia and mechanical ventilation in a patient with moderate COPD and multiple rib fractures. We also achieved excellent pain control by avoiding the use of opioids with related side effects, especially in a COPD patient.<sup>18</sup> Potential advantages of neuraxial and regional analgesia over systemic therapies are: decreasing adverse effects compared to some conscious sedation techniques or general anesthesia (e.g., hypoxia, agitation, nausea/vomiting), decreasing need for sedatives, improving neurologic assessment, reducing in opioid requirement and opioid-related adverse events, reducing in length of stay in emergency or critical care units, improving comfort and safety for transport, reducing in the stress response to injury.<sup>19</sup> Neuraxial techniques, in our case spin-epidural anesthesia, have numerous advantages in lower limbs trauma surgery. Spinal anesthesia allows rapid achievement of the desired anesthetic level. The epidural catheter allows to extend the duration of the anesthesia, reducing spinal dosages and ensuring greater hemodynamic



**Figure 2.** Minimally Invasive Plate Osteosynthesis in left distal femur fracture (A), blocked short intramedullary nail in proximal right femur fracture (B), percutaneous disto-proximal infibulum system for both the ulna and the radius fractures (C).



stability. The epidural catheter can remain in place for up to 72 hours and be used for optimal postoperative pain control.<sup>20</sup>

Upper extremity blocks appear to confer several advantages. In patients with upper extremity fractures, supraclavicular block for their procedure experienced a shorter length of stay without any impact on patient safety and good satisfaction.<sup>21</sup>

## Conclusions

We have successfully treated major trauma in a spoke hospital thanks to the collaboration between various specialist figures, in particular anesthesiologists, orthopedists, radiologists. Basic trauma training is always required in this professional figures.

We have chosen the analgesic and anesthetic techniques that we considered most suitable for the patient, considering her age, her clinical history, the type of damage reported. In our opinion and based on our resources, we have achieved an excellent result in terms of anesthetic management as well as preoperative and postoperative pain control. The orthopedic approach with minimally invasive techniques is also noteworthy, despite the complexity of the patient. We report that the patient was fully satisfied with the treatment received, happy to have been able to avoid general anesthesia which she knew was risky for her condition. We admitted the patient to the ICU in consideration of the patient's comorbidities (cardiovascular and respiratory), which required intensive monitoring for the first postoperative days.

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