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Comparation of early continuous epidural and intravenous opioid analgesia on haemodynamic changes after several pelvic fractures

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Abstract

Background and Purpose: *Continuous epidural analgesia improves excellent pain control in trauma patients with multiple pelvic fractures. Rezidual haemodynamic instability followed by retroperitoneal hemorrhagie in the first 48 hours often post-pones its application with need for parenteral use of high dose of opioids. The aim was to compere the influence of early continuous epidural and intravenous opioid analgesia on haemodynamic changes in these patients.*

Materials and Methods: *After Ethic Committee approval, fifty trauma patients with isolated multiple pelvic fractures were divided in two equal groups and included in prospective, randomized study. In bought groups initial analgesia was started with sufentanil 10 $\mu g\ h^{-1}$ in the first 24h. After that, in Group EP continuous epidural analgesia (levibupivacain O.125%, 5–7 $mL\ h^{-1}$) and in Group O continuous infusion of opioid (sufentanil 5–10 $\mu g\ h^{-1}$) was started. The analgesics dose was titrated following the VAS score under 3. PICCO monitoring was established. MAP, CI, HR, SVRI, ITBVI and ELWI was measured during four days. Statistic analysis was done by SPSS 11.0.*

Results: *Study groups were statistic comparable. In the first 24 hours during continuous opioid anaesthesia, bought groups had high need for fluid replacement (Group EP=3.2 ± 0.3, Group O=3.0 ± 0.5 L/24h) (P=0.0928). Second day, SVRI was lower in O Group (1300–1520; EP Group=1700–1810) (P=0.0243) and recovered with 500–750 mL of crystalloids infusion. ITBVI was statistical more stable in Group EP (950 ± 50; Group O (1100 ± 30) (P=0.0002). Only 10% of patients with low CI (<3.0) in Group EP (Group O=32%) needed catecholamin support.*

Conclusion: *Early continuous epidural analgesia with 0.125% levibupivacain is safe as continuous opioid analgesia in patients with multiple pelvic fractures but without opioids complications and better haemodynamic stability.*

INTRODUCTION

Continuous epidural analgesia improves excellent pain control in trauma patients with multiple pelvic fractures. Residual haemodynamic instability followed by retroperitoneal haemorrhage characteristic with volume replacement and blood transfusion, usually post-pones epidural analgesia placement for 48 hours after injury. During this time, there is need for parenteral use of high dose of opioids including

all negative site effects from unwonted high sedation, nausea and disturb in bowel function *(1)*. Isolated pelvic bone fracture often are associated with traumatic shock and blood loss in retroperitoneum space what my result in early haemodynamic instability *(2)*.

Epidural analgesia alone or in combination with low doses of continuous, intravenous opioid makes the gold standard in patients with pelvic fracture after patient circulatory stability and normalization of posttraumatic thrombocytopenia. Krõll W et co-workers suggested regional application of analgesic drug alone or systemic infusion of sufentanil 0.25–0.3 $\mu g\ kg^{-1}\ h^{-1}$ in spontaneously breathing patients after thorax and pelvic trauma. They noted also successful combination of epidural and intravenous opioid analgesia in vindicated indication and modified dose of opioid and local anaesthetic *(3)*. It is well know that epidural supplemented opioid to local anaesthetic solution provide high quality analgesia. Beavis RE has shown that in lumbal epidural analgesia opioids do not has clinically apparent effect on the circulation or on specific organ blood flow to compare with systemic use of opioids *(4)*.

Severe hypotension with short analgesia duration could be detected after bolus epidural local anaesthetic administration. Continuous epidural infusion of anaesthetic is recommended to prevent or minimize these side effects *(5)*.

The aim of our study was to compare the influence of early continuous epidural analgesia after first 24 hours of pelvic trauma on haemodynamic stability.

MATETRIAL AND METHODES

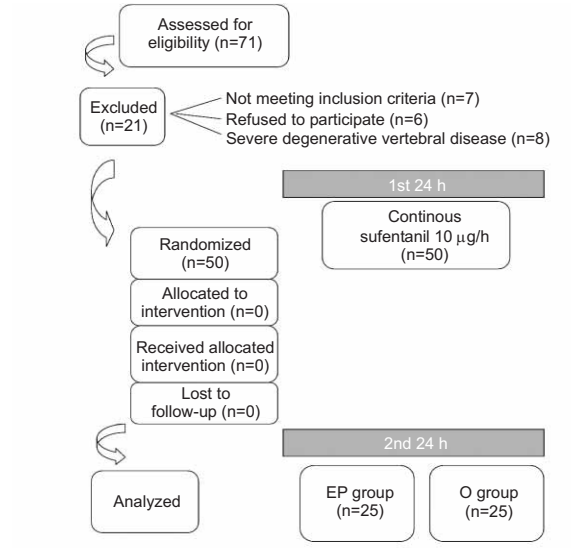
After Ethic Committee of University Clinic of Traumatology approval, fifty patients with isolated multiple pelvic fractures were included in prospective, randomized study during six months period. Patients with degenerative vertebral disease or earlier spine surgery were excluded from the investigation. Patients were divided in two equal groups. In bought groups initial analgesia was started with continuous infusion of sufentanil 10 µg/h in the first 24h after trauma. The second day detection of epidural space et Th_{12}-L_1 level was done and epidural catheter (4 cm distally of the punction site) was placed in the situ (Picture 1). In Group EP continuous epidural analgesia (0.125% levibupivacain; 5–7 $mL\ h^{-1}$) was started at the second day. In Group O continuous infusion of opioid (sufentanil; 5–10 $\mu g\ h^{-1}$) was continued. Titration dose of analgesics has followed the VAS score (<3; 1/100) in the bought groups. It was checked every hour by intensive care nurses. Central venous access was establish and central venous pressure was measured (CVP; mmHg). Pulse Contour Cardiac Output (PICCO) haemodynamic monitoring was establish by canulation of artery in cubital fossa. Mean arterial blood pressure (MAP; mmHg), cardiac index (CI 3.0–5.0; $L\ min^{-1}\ m^{-2}$), heart rate (HR; $L\ min^{-1}$), systemic vascular resistance index (SVRI 1700–2400; dynes $s\ cm^{-5}\ m^2$), intrathoracic blood volume index (ITBVI 850–1000; $mL\ m^{-2}$) and extravascular lung water index (ELWI 3.0–7.0; $mL\ kg^{-1}$) was measured. Crystalloid or/colloid solution were administered following these haemodynamic parameters. Use of catecholamine drug (dobutamin) was indicated by ITBVI $<850\ mL\ m^{-2}$ and EVWI $<10\ mL\ kg^{-1}$) independent of CI, and/or (norepinephrine) was added by low SVRI <800 dynes $s\ cm^{-5}\ m^2$ and CI$<3.0\ L\ min^{-1}\ m^{-2}$ if MAP was less than 80 mmHg.

To detect 30% of difference in haemodynamic stability between EP and O Group we calculated the sample site of 25 patients per group by 95% power of the study and alpha error less than 0.01. Statistic analysis was done by SPSS 11.0 statistical package.

RESULTS

Seventy-one patients with severe trauma pelvic fracture were scheduled for continuous intravenous or epidural analgesia (Figure 1). Twenty-one of them were excluded before randomization (7 patients did not meet inclusion criteria, 6 refused to participate and 8 patients had degenerative vertebral disease).

The study groups were comparable in demographic data (Table 1).



Flow-diagram of patients distribution.
Epidural catheter for epidural analgesia in situ.

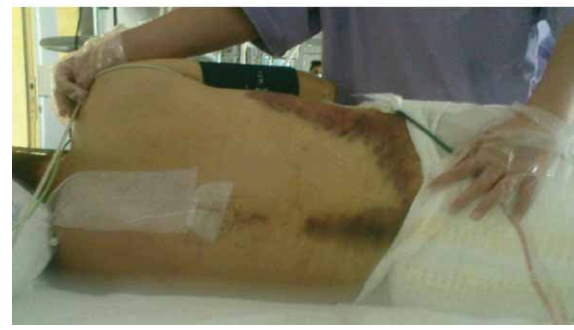


Figure 1. *Epidural catheter for epidural analgesia in situ.*

TABLE 1

Demographic and procedural characteristics of study groups.

	Group EP n=25	Group O n=25	P value
Age (years)	57 ± 12	62 ± 7	0.0782
Gender (male) (%)	60	67	0.069$^{\Delta}$
BMI (kg m^{-2})	25 ± 4	27 ± 4	0.0835
ASA II/III (%)	75	70	0.263$^{\Delta}$
VAS score/24h	30 ± 3	28 ± 3	0.0225
VAS score/48h	15 ± 1	20 ± 2	0.0000*
Opioid consumption/24/h (ug)	220 ± 15	217 ± 10	0.4095
Opiod consumption/48/h (ug)	0	200 ± 13	
Local anaesthetic consumption/48h (mL)	160 ± 8	0	
Volume compensation above daily requrement/24/h (L)	3.2 ± 0.3	3.0 ± 0.5	0.0928
Volume compensation above daily requrement/48/h (L)	2.2 ± 0.1	2.7 ± 0.3	0.0000*
Analgesic procedure complication (%)	3	17	0.001$^{\Delta}$*

$^{\Delta}$ Fisher-exact test, One-way ANOVA
* Statistic significance with P value <0.005

VAS score was equal or less than 30 in first 24 hours during continuous intravenous infusion of sufentanil in all patients (Group EP=30 ± 3, Group=28 ± 3)(P= 0.225). Mean opioid rate in first 24 hours was 8.7 µg/h with equally mean total consumption of sufentanil (Group EP= 220 ± 15, Group O=217 ± 17 µg)(P=0.4095)(Table 1).

High need for fluid replacement above daily requirements for pelvic trauma was present in the first 24 hours in all patients (Group EP=3.2 ± 0.3, Group O=3.0 ± 0.5 L) (P=0.0928) with ELWI less than 10 mL/kg and ITBVI less than 850 mL/m^2 independent of baseline CI value (Figure 2).

The second day, under continuous epidural analgesia need for volume compensation was still high (2.2 ± 0.1 L) but significant less to compare continuous opioid analgesia (2.7 ± 0.3 L)(P=0.0000)(Table 1, Figure 2). ITBVI was statistical more stable in Group EP (950 ± 50; Group O=1100+/30) (P=0.0001) specially by patients with low CI<3.0 (1000 ± 120; Group 0=1200 ± 70) (P=0.0000) to compare Group O (Figure 2).

In patients with CI <3.0 during intravenous opioid analgesia lower SVRI (1200 ± 90; Group EP=1800 ± 70 dyn*s*cm^{-5}*m^2) and MAP (90 ± 5 mmHg) were present during the 2nd day what primary result in higher fluid re-

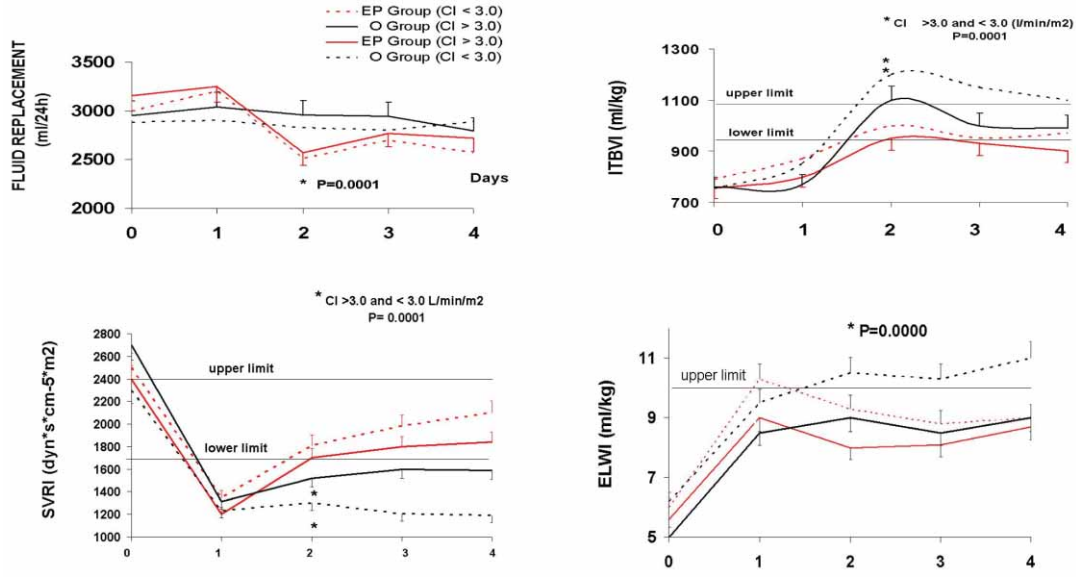


Figure 2. *Fluid replacement, ITBVI, SVRI and ELWI 2nd day after haemorrhagae stabilisation under continuous epidural and intravenous sufentanil analgesia for pelvic fracture.*

placement to compare Group EP. Finally, ELWI enhanced over >10 mL/kg indicated volume overloud.

In patients with low CI<3.0, in EP Group ELWI was less than 10 and fluid replacement gently was continued.

In Group O, ITBV was high 930 ± 70 mL/m^2, ELWI less than 10 mL/kg and by low SVRI there was higher frequency of catheholamin support (32%; Group EP 10%)(Figure 3).

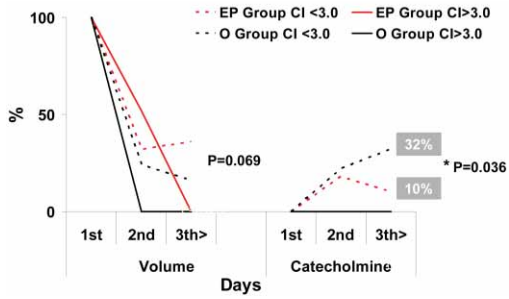


Figure 3. *Volume and catecholamin use by CI<3.0 (L/min/m^2) during epidural and opioid analgesia.*

DISCUSION

Adequate treatment of pain in ICU patients should be an integral part of ICU management. Continuous intravenous infusion of opioids or/and continuous epidural analgesia are useful. During the second day after pelvic trauma, successful pain score was achieved by bought, continuous epidural and intravenous opioid analgesic therapy but with significant lower VAS score during continuous epidural analgesia (Group EP=15 ± 1, Group O=20 ± 2)(P=0.0000). Higher intravenous dose of opioid usually had to be used to achieve equal VAS score. Patient-controlled analgesia (PCA) may better control opioid consumption when intravenous continuous analgesia is used insevere trauma patient *(8)*. In our study, significantly lower systemic vascular resistance accompanied continuous intravenous analgesia of opioid at second day after pelvic tauma, specially in patient with lower cardiac index (<3 L min^{-1} m^{-2}). Consequently, there was higher need for volume replacement and significant increase of catecholamine use to compare continuous epidural analgesia. Following these results we may conclude that continuous epidural analgesia provides better postoperative pain control and haemodynamic stability in patient with lower CI after severe pelvic fracture. Azad SC has shown in his study lower incidence of nausea and sedation compared to intravenous opioid analgesia *(7)*. Early continuous epidural analgesia with 0.125% levibupivacain is safe as continuous opioid analgesia in patients with multiple pelvic fractures but without opioid complications and better haemodynamic stability. Continuous epidural analgesia is special good choice for patients with lower CI (<3.0 L/min/m^2) where need for catecholamine use was significantly lower to compare continuous intravenous opioid analgesia. Shigihara A has described significantly lower duration of continuous epidural block after seven days. The reason for that was found in decrease of anaesthetic spread due to adhesion around the catheter in the epidural space. Following their results, two weeks make a safety period for success of continuous epidural block *(8)*.

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