CASE REPORT

Precise Insertion of Epidural Analgesia at the End of Surgery Increased Success Rate in Management of Post-Spine Surgery Pain

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ABSTRACT

Background: Severe postoperative pain remains a problem in patients with post-spine surgery. Epidural analgesia offers a lower pain score and fewer rescue analgesic requirements than conventional systemic analgesia in post-spine surgery.
Case: We reportedfour cases of postoperative pain management in patients withpost-spine surgery with epidural analgesia. The first and second patient had inferior flaccid paraplegic due to a compression fracture of thoracic vertebrae 10-11 and 11-12, respectively. Thethird and fourthpatient had hernia nucleus pulposus (HNP) of lumbar 4-5 and lumbar 5-sacral 1, respectively.Near the end of the surgery, an epidural catheter wasinserted by neurosurgeon in the epidural space. After surgical wound closure, a bolus of 10 ml bupivacaine 0.125% was injected throughan epidural catheter shortly after the patientswere positioned supine. Postoperative pain was managed by injecting bupivacaine 0.125% continuously. Patients wereadministered by paracetamol 1000 mg every 6 hours. If the patients still suffered from pain, they would be administered by intravenous fentanyl 100µg as rescue analgesic. Postoperative pain was assessed bynumeric rating scale (NRS) at 0, 6, 12, 18, 24, 36, 48 hours. Blood pressure, heart rate, and side effects were recorded. After surgery, the patients' hemodynamic condition was stable, and there were no other complaints. NRS for 48 hours postoperatively was less than 3. No side effects were found regarding this treatment.
Discussion: Epidural catheter inserted at the end of surgery by neurosurgeon together with anaesthesiologist under direct vision ensured that the epidural catheter was inserted in the precise location and increased the success rates.
Conclusion: Epidural analgesia in spine surgery was effective in managing post-operative pain by providing good safety and extended analgesia.
Keywords: Epidural analgesia; postoperative pain; spine surgery; anesthesiologist;neurosurgeon

INTRODUCTION

It has been well documented that immediate post-operative pain control could significantly improve the outcome of surgical procedures and morbidity, however severe postoperative pain remains a major problem for postoperative patients. Acute uncontrolled postoperative pain is associated with patients'discomfort and unsatisfaction, postoperative complications, longer hospital stay, delayed rehabilitation, worse patients' quality of life, and risk factors for developing chronic pain[1].

Spinal surgery is one of surgery with severe postoperative pain[1,2]. The sources of post-operative pain in spine surgery are including skin incision, muscle tissue inflammation, neuron and radix, vertebral boneexcision and internal fixation apparatus that affect to surrounding tissues[1,2]. Stress responses associated with surgical trauma may also cause subtle changes in some vital and hormonalparameters. Increased plasma cortisol levels and suppressed anabolic hormones, such as insulin, may havedeleterious effects during the perioperative period[3].

Most of spine surgeries are performed under general anesthesia. Postoperative management is usually performed conventionally with paracetamol, nonsteroidal anti-inflammatory drugs (NSAIDs),and opioids that are used alone or in combination[4].

Epidural analgesia is the administration of analgesia drugs into the epidural space. Most epidural analgesic regimenssignificantly reduced postoperative pain and reducedtherequirement for supplementary parenteral analgesics.This technique has several advantages over the use of systemic opioids because it can reduce mortality, incidence of complications and pulmonary infections, intestinal complications, and postoperative cardiac complications[5]. While its adverse effects were rare[2].

Epidural analgesia is rarely applied dueto lower acceptance for epidural analgesia by patients, the flexibility to extend the duration of surgery in the generalanesthesia, and/or the anesthesiologist preferencefor general anesthesia because of a secure airwayestablishment prior to placement of the patient inthe prone position[6].

Insertion of an epidural catheter can beperformedbefore surgical incision, intraoperatively, or at the end of the operation. The last approach that is performed by neurosurgeon under direct vision, may ensure the preciselocation of the epidural catheterinsertion at epidural space, so that the analgesic drug is expected to be more effective and to increase the success rates[1,2,4,5].

However, there is still limited study about the effectiveness of epidural analgesia that is inserted intra-operatively or at the end of surgery by neurosurgeon in collaboration with anesthesiologist to manage post-spine surgery pain. This case report will report our successful experiences in epidural analgesia inserted at the end of surgery by neurosurgeon in collaboration with anesthesiologist to manage post-spine surgery pain.

CASE ILLUSTRATION

We reportedfour cases of postoperative pain management in patients who underwent spine surgery with epidural analgesia in Dr. Kariadi General Hospital Semarang and Diponegoro National Hospital, Semarang, Indonesia.

The first patient was a male, Asian (Jawanese), 50 years old, with body weight of 61 kg and height of 160 cm. He had inferior flaccid paraplegic and hipesthesia in both legs from toes to dermatom T10 – T11 due to a compression fracture of thoracic vertebrae 10-11. The second patient was a male, Asian (Jawanese), 47 years old with body weight of 61 kg and height of 164cm. He also had inferior flaccid paraplegic due to a compression fracture of thoracic vertebrae 11-12.The third patient was a male, Asian (Jawanese), 55 years old, with body weight of 66 kg and height of 162 cm.He had bilateral ischialgia and leg paresthesia due to hernia nucleus pulposus (HNP) of lumbar 4-5.The fourth patient was a male, Asian (Jawanese), 57 years old, with body weight of 68 kg and height of 168 cm.He also had bilateral ischialgiaand leg paraesthesia HNPof lumbar 5-sacral 1.All patients showed normal central nervous system and normal sinus rhythm in electrocardiogram.

The baseline history, physical examination, and laboratory examination are presented in table 1, 2, and 3. The magnetic resonance imagings are presented in table 4. Patient 1 and 2 underwent pedicle screw rod system (PSRS) procedures, whilepatient 3 and 4 underwent endospine disectomy. All patients were ASA I. Durations of surgery in patient 1, 2, 3, and 4 were 246±5.0 min,274±6.0 min, 265±8.0 min,and 249±7.1 min, respectively.

Anesthesia Management: Intravenous midazolam 5 mg wasadministered as premedication that was given in the operating room. Induction was using propofol2 mg/kg body weight, fentanyl 100 µg, and rocuronium 40 mg. Anesthetic maintenance was gained with sevoflurane, continous fentanyl 30 µg/jam, and rocuronium 10 mg as needed.Ventilatormode was settingwith synchronized intermittent mandatory ventilation (SIMV), withFiO2 60%, respiratory rate (RR) 12, tidal volume (TV)±400 ml, positive end expiratorypressure (PEEP)5 mmHg, and inspiration:expirationratio (I:E ratio) 1:2.

Neurosurgeon inserted an epidural catheter in the epidural space near the end of the surgery(Figure 1, 2,3, and 4). Epidural catheter was fixated in the lower corner of the incision wound, then the incision wound was closed.After surgical wound closure, 10 ml of bupivacaine 0.125% was injected via an epidural catheter shortly after the patientswere positioned supine. Postoperative pain was managed by injecting bupivacaine 0.125% continuously. Patients were also administered with paracetamol 1000 mg every 6 hours.If patients still suffered from pain, they would be administered with intravenous fentanyl 100 µgas rescue analgesic.

Postoperative pain was assessed using numeric rating scale (NRS). The first timewhen patientswere awaken and could provide information about the pain score,was considered as the 0 hour point. The pain score wasassesses at 0, 6, 12, 18, 24, 36, 48 hours(Table 5).Systolic and diastolic blood pressure, heart rate, and side effects were recorded during (Figure 5, 6, 7) and post-surgery (Figure 8 and 9).

Postoperative Monitoring: Total postoperative analgesia used in the first, second, third,and fourth case were 7±1.5 mg, 8±1.4 mg, 10±1.6 mg and 6±1.2 mg, respectively. Time to first analgesia demand in the first and second case were 195.0 min, 189.0 min, 192.5 min and 197.0 min, respectively. After surgery, patients' hemodynamic conditions were stable, and there were no other complaints. There was no significant tachycardia and hypertension occurred intra- and peri-operatively in all cases (Fig. 5 – 9).

Epidural analgesia in spine surgery was effective in managing post-operative pain. One of the benefits was a lower pain scores, i.e. NRS for 48 hours postoperatively was less than 3 (table 5), and no rescue analgesic were needed within 48 hours. Incidence of postoperative nausea and vomiting (PONV) was not occurred. No other side effects were found regarding this treatment.

Epidural catheter insertion at the end of surgery ensured that the epidural catheter was inserted in the precise location. Other benefits were less need for opioids, faster recovery of intestinal peristaltic, less blood loss from surgery, and higher level of patient satisfaction.

Motorand sensory function were uninterrupted in patient 3 and 4, while for patient 1 and 2, they could not be assessed because patients suffered from paralysis. Catheter related bladder discomfort (CRBD) could not be assessed. Urine retention could not be assessed because both of patients were using urinary catheters.

In 1 and 2 week follow up at out-patient clinic, all cases showed excellent results that showed no significant postoperative pain.

Fig. 1. Insertion of Epidural Catheter by Neurosurgeon in Patient 1

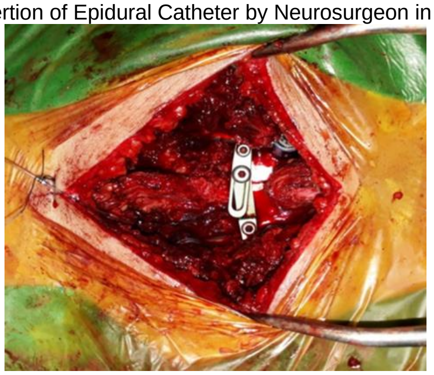


Fig. 2. Insertion of Epidural Catheter by Neurosurgeon in Patient 2

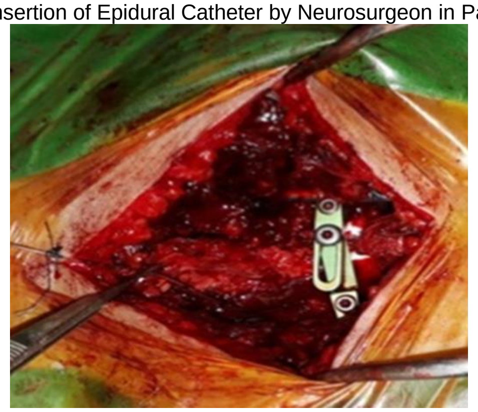


Fig. 3. Insertion of Epidural Catheter by Neurosurgeon in Patient 3

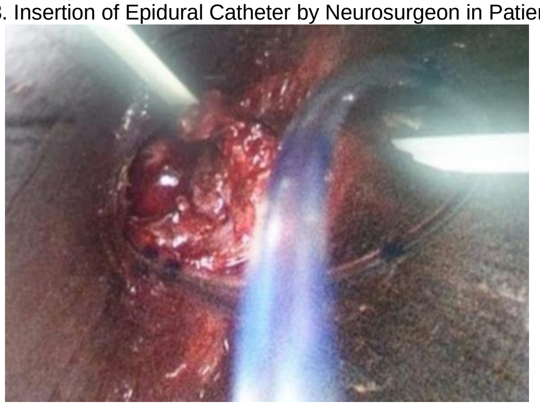
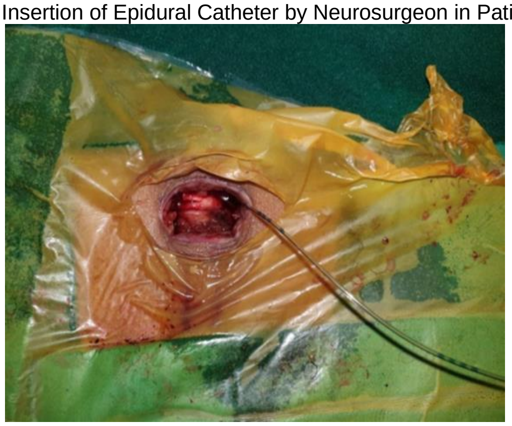


Fig. 4. Insertion of Epidural Catheter by Neurosurgeon in Patient 4



DISCUSSION

More evidences recently showed that regional anaesthesia is more beneficial in spinal surgery, including lower neurological damage and lower infection rates. Epidural analgesia for pain relief after spinal surgery is an effective and safe method.Although an epidural catheter is usually placed by the neurosurgeon prior to theclosure of the surgical wound, the numbers and positionsof the catheters inserted, the types and amounts of agentsused, and the mode of administration vary widely in the literature[7]. It gives a drier operating field, less bleeding, and stilly post-operative condition.[(8)]Recent meta-analyses showed that epidural analgesia was superior in analgesic effect when compared with intravenouspatient-controlled analgesia (PCA), making it possible to reduce theamount of analgesics used postoperatively[7]. However the application of neuroaxial anaesthesia techniques for intraoperative anaesthesia and post-operative analgesia for spinal surgery is still controversial. Some surgeons werestill reluctanttoinsert epidural catheter within or near their surgical fields due tosome of their theoretical concerns[4,5].

Similar to other reports[6], our case report also showed some benefits of epidural analgesia, including lower pain scores[9], less need for analgesics used postoperatively or opioids[7], faster recovery of intestinal peristaltic, lower incidence of nausea and vomiting, less blood lossduring surgery, and higher level of patient satisfaction[2,10].

Epidural analgesia for spinal surgeries can be administered before surgery[9], during surgery[5], or at the end of surgery,meanwhile, in our cases, we chosed to insert epidural analgesia catheter at near the end of surgery. It is often difficult to place the catheter preoperatively in spine surgeries. And, if it is possible to place epidural catheter before surgery, the disadvantage of inserting catheters and administering the drug beforeincision, is that it requires a greater volume of drug because the catheters areusually insertedin 2–3 segment below or above the estimated incision limit.Otherdisadvantages of this pre-operative catheter technique are the risk of being revoked or pulled out, the risk of widening the surgical incision to the catheter insertion site so that the epidural catheter should be removed, or the risk for the tip of the catheter for not precisely in the epidural cavity.

In line to our report, Turner et al also showed placement of epidural catheters under direct vision by the neurosurgeon at the end of the procedure, followed by an epidural infusion of local anaesthetic with or without an opioid. Similar to our results, they also showed that correctly placed ‘surgical’ epidural catheters were capable of providing good analgesia after posterior spinal fusion. The advantage of inserting an epidural catheter by neurosurgeon was that the catheter was really located in the epidural space rather than anywhere else especially in the subarachnoid space. The tip of the catheter would not enter the blood vessels. Less medicine was needed. However, its disadvantage was not giving analgesic from the beginning of the surgery so that it could not affect the drug during anaesthesia[11].

Moreover, althoughit is simple to insert the epidural catheter in the epiduralspace as soon as the surgical procedure is over, several issues need to be considered. In epidural analgesia,thedrug actionmay sometimesbe interfered by the presence of blood. The presence of a drain tube with or without suction might lead toinadequate retention of the analgesic drug in the epidural space. Safe and secure fixation and retention of the catheter are also important issues[12].

Epidural analgesia can be used in all types of spinal surgery such as microdisectomy, laminectomy, instrumentation with or without correction, and correction of scoliosis[2,10]. The injected drugsin epidural analgesia can be local anaesthetic drugs, opioids, or their combination. The drug administrationcan be single bolus, continues infusion, or patient control epidural analgesia(PCEA)[9,10,12]. The drugs that are usedmostly consist oflocalanaesthetic drugs,such as bupivacain orropivacain 0.0625–0.3% with or without opioids, or opioid alone. Morphine and fentanylareopioids that arecommonlyused. Opioid that is given through epidural can give a better analgesia compared with parenteral at the same dose[13]. Some other adjuvantsthat are less usedare clonidin, metilprednisolon, and midazolam[2,10].

Moon MR et al showed that epidural analgesia was associated withsignificantly reduced plasma levels of IL-8, verbalrating score of pain, and maximal inspiratoryforce and tidal volume versus patient-controlled analgesia (PCA). Epidural analgesia significantly reduced pain with chest wall excursion compared with PCA.Serumlevels of IL-8,a proinflammatory chemoattractant that has been implicated inacute lung injury, were significantly reduced in patients receivingepidural analgesia. This may have importantclinical implications because lower levels of IL-8 may reduce infectious or inflammatory complications in the trauma patient.Tidalvolume and maximal inspiratory force were also improvedwith epidural analgesia. Their results demonstrated thatepidural analgesia was superior to PCA in providing analgesia, improving pulmonary function, and modifying the immune response in patients with severe chest injury[13].

Our team often use combinedepidural general anaesthesia (CEG) techniques for spinal surgerysuch as in this case report. The surgery is done under general anaesthesia. In some cases, we first put the epidural catheter before the skin incision. The catheter is inserted before or after induction of anaesthesia before incision. While in this case report, the neurosurgeon placed a catheter in the epidural space at the end of the operation. The drug that we injected was 10 ml bolus of 0.125% bupivacain followed by 0.125% continuous bupivacaine infusion of 3 ml/hour. Another analgesic used was paracetamol. The advantages are lower anaesthetic agents, stable hemodynamic so that bleeding is less, postoperative pain is low so that opioid use is smaller, nausea vomiting is reduced, and patients are more satisfied.

Khajavi et al. have compared general anaesthesia (GA) versus CEG for spinal surgery. They found that CEG offered several advantages including controlled hypotension techniques that couldsignificantly reduce blood loss (up to 35%), as well as attain faster onset and recovery and minimal undesirable effects. In line to our experience, Khajavi et al. showed that CEG gave less use of anaesthetic agents, lower postoperative pain, lower analgesic consumption, and less nausea and vomiting[8].

The results of our observation of four patients underwent spinal surgery who received epidural therapy obtained good results. During the 48 hour assessment the NRS value of the two patients were always below 3. This might be due to the proper placement of the epidural catheter so that the inserted drug completely filled the epidural space. Administration of 10 ml of epidural drug volume followed by 3 ml/hour was sufficient. Side effects of nausea and vomiting were not found. This might be because we did not use opioids for adjuvants.

CONCLUSION

Management of post-surgery pain become the responsibility of the anesthesiologist and surgeon. Insertion of an epidural catheter towards the end of surgery manually or with the aid of an endoscope ensures that the epidural catheter is placed in the right location. Epidural analgesia in spinal surgery has been shown to be effective in managing postoperative pain.

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Table 1: Baseline Historyof Subjects

	Patient 1	Patient 2	Patient 3	Patient 4
History taking (Anamnesis)	- History of falling since 3 months. - Hecould not move both his legs. - He hadhipeasthesia in both feet from toes to the pelvis. - He could notdefecateandurinate.	- History of falling since 1 months. -He could not move both his legs. - He had hipeasthesia in both feet from toes to the pelvis. - He could not defecateand urinate.	- Patient complained lower back painsince 3 years before admission, and was worsening in the last 2 weeks.-Pain was creepingtoboth legs - Pain increased with cough, bent down, and valsava. - He used to take painkillers. - He complainedparaesthesiabut no paralysis. - He has had physiotherapy. - He could normally defecate andurinate.	- Patient complained lower back pain since 2 years before admission, and was worsening in the last 1 week. - Pain was creepingtoboth legs - Pain increased with cough, bent down, and valsava. - He used to take painkillers. - He complained paraesthesia, but no paralysis. - He has had physiotherapy. - He could normally defecate andurinate.
History of Medication	Metilprednisolon 62.5 mg/12 hours Vitamin B12 50 µg/ 24 hours Paracetamol 500 mg/ 8 hours Ranitidin 50 mg / 12 hours	Metilprednisolon 62.5 mg/12 hours Vitamin B12 50 µg/ 24 hours Paracetamol 500 mg/ 8 hours Ranitidin 50 mg / 12 hours	Ketorolac 30 mg / 8 hours Paracetamol 500 mg/ 8 hours Gabapentin 100 mg / 12 hours Vitamin B1, B6, B12 1 mg /8 hours Ranitidin 50 mg / 12 hours	Ketorolac 30 mg / 8 hours Paracetamol 500 mg/ 8 hours Gabapentin 100 mg / 12 hours Vitamin B1, B6, B12 1 mg /8 hours Ranitidin 50 mg / 12 hours
History of Other Illness	No history of asthma, allergy, fever, diabetes mellitus, hipertension, heart disease, nor previous surgery.	No history of asthma, allergy, fever, diabetes mellitus, hipertension, heart disease, nor previous surgery.	No history of asthma, allergy, fever, diabetes mellitus, hipertension, heart disease, nor previous surgery.	No history of asthma, allergy, fever, diabetes mellitus, hipertension, heart disease, nor previous surgery.

Table 2: Baseline Physical Examination

	Patient 1	Patient 2	Patient 3	Patient 4
Vital Sign				
Consciousness	GCS 15	GCS 15	GCS 15	GCS 15
Blood Pressure (mmHg)	110/70	130/70	120/70	110/70
Mean Arterial Pressure (mmHg)	83	85	86	83
Heart Rate (/min)	75	84	82	78
Respiratory rate (/min)	12	14	12	16
Numeric Rating Scale	4	6	6	4
Eye	Isokor, normal light reflex	Isokor, normal light reflex	Isokor, normal light reflex	Isokor, normal light reflex
Neurological Examination				
Superior Extremities				
Motoric				
Movement				
Power	+ / +	+ / +	+ / +	+ / +
Tonus	555 / 555	555 / 555	555 / 555	555 / 555
Physiological Reflex	normal / normal	normal / normal	normal / normal	normal / normal
Pathological Reflex	++ / ++	++ / ++	++ / ++	++ / ++
	-/-	-/-	-/-	-/-
Sensibility				
	normal / normal	normal / normal	normal / normal	normal / normal
Inferior Extremities				
Motoric				
Movement				
Power	- / -	- / -	+ / +	+ / +
Tonus	000 / 000	000 / 000	555 / 555	555 / 555
Physiological Reflex	reduced / reduced	reduced / reduced	normal / normal	normal / normal
Pathological Reflex	+ / -	- / -	++ / ++	++ / ++
	- / -	- / -	- / -	- / -
Sensibility	Hipesthesia fromtoes to dermatom T10– T11	Hipesthesia fromtoes to dermatom T11 – T12	Paresthesia with dermatom L4 –L5	Paresthesia with dermatom L5 –S1

Table 3: Baseline Laboratory Examination

	Patient 1	Patient 2	Patient 3	Patient 4
Hemoglobin(g/dL)	12.6	12.8	13	13.2
Hematocryte (%)	37.8	38.2	39.1	38.6
Thrombocyte (/µl)	226,000	287,000	238,000	243,000
Leucocyte(/µl)	8,500	9,100	6,200	7,200
Electrolyte				
Sodium (mmol/L)	136	138	142	140
Potassium (mmol/L)	4.6	4.2	3.8	4.0
Chloride (mmol/L)	99	100	102	98
Random Blood Glucose (mg/dL)	86	88	83	89
Albumin (g/L)	3.5	3.5	3.5	3.4
Ureum (mg/dl)	30	29	28	27
Creatinine (mg/dl)	0.7	0.8	0.9	0.7

Table 4. Magnetic ResonanceImaging Examination

Patient 1	Patient 2	Patient 3	Patient 4
Anterior wedge compresion fracture of vertebrae T11 and bone marrow edema of T11. Retrolisthesis of corpus T11that causedspinalcanalstenosis, spinal cordcompression, and spinal cord contusion in the levelof vertebrae T10 – T11. Stenosis ofintervertebral disc space T10- T11. Stenosisof right and left neural foramen in the level of vertebrae T10 – T11.	Anterior wedge compresion fracture of vertebrae T12 and bone marrow edema of T12. Retrolisthesis of corpus T12that caused spinalcanal stenosis, spinal cord compression, and spinal cord contusion in the level of vertebraeT11 – T12. Stenosis ofintervertebral disc space T11- T12. Stenosisof right and left neural foramen in the level of vertebrae T11 – T12.	Degenerative process intheintervertebraldisc of vertebrae L4 – L5. Posterocentral bulging in theintervertebraldisc L3 – L4 withthecal sac pressing, but without stenosis inneural foramen. Posterocentral protusio inintervertebraldisc L4 – L5, with thecal sac pressing with right and leftneuralforamen stenosis on those levels. No fracture in lumbosacral vertebra.	Degenerative process intheintervertebraldisc of vertebrae L5 –S1. Posterocentral bulging in theintervertebraldisc L4 – L5with thecal sac pressing,but without stenosis in neural foramen. Posterocentral protusio inintervertebraldisc of L5 – S1,withthecal sac pressing with right and left neural foramen stenosis on those levels. No fracture in lumbosacral vertebra.

Table 5: Numeric Rating Scale (NRS) in Post-Spine Surgery with Epidural Analgesia

Time (Hours)	0	6	12	18	24	30	36	48
Patient 1	2	2	2	1	1	1	1	1
Patient 2	2	2	1	1	1	1	1	1
Patient 3	2	2	1	1	1	1	1	1
Patient 4	2	2	2	1	1	1	1	1

Figure 5. Systolic Blood Pressure during Surgery (S) (mmHg) (1,Patient 1; 2, Patient 2; 3, Patient 3; 4, Patient)

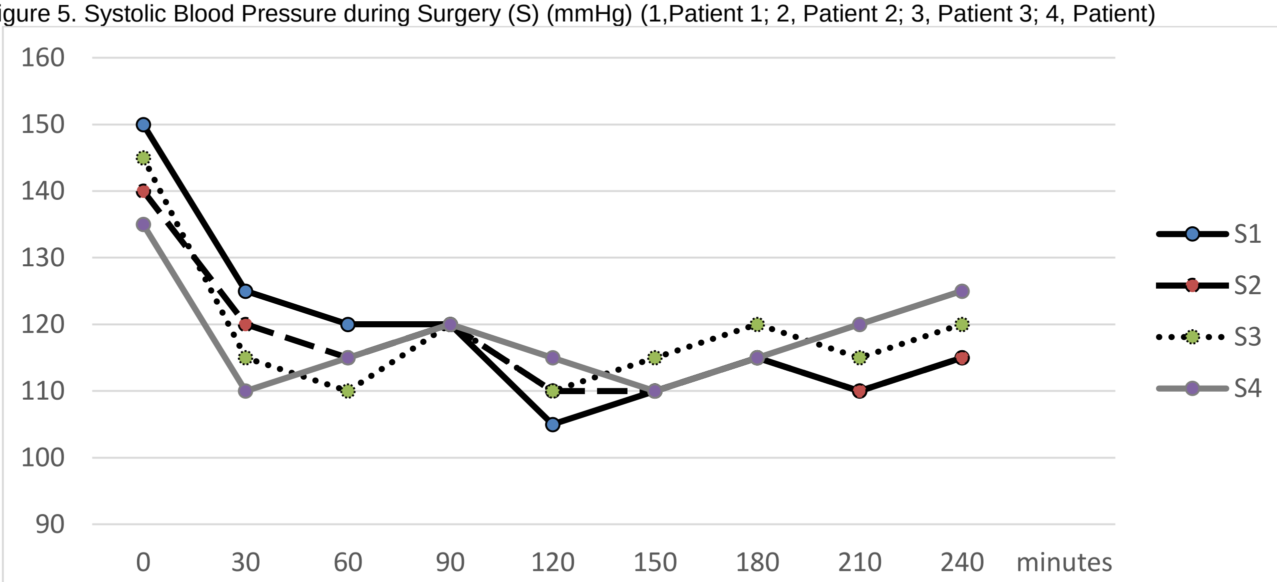

Figure 6. Diastolic Blood Pressure during Surgery (D) (mmHg) (1, Patient 1; 2, Patient 2; 3, Patient 3; 4, Patient)

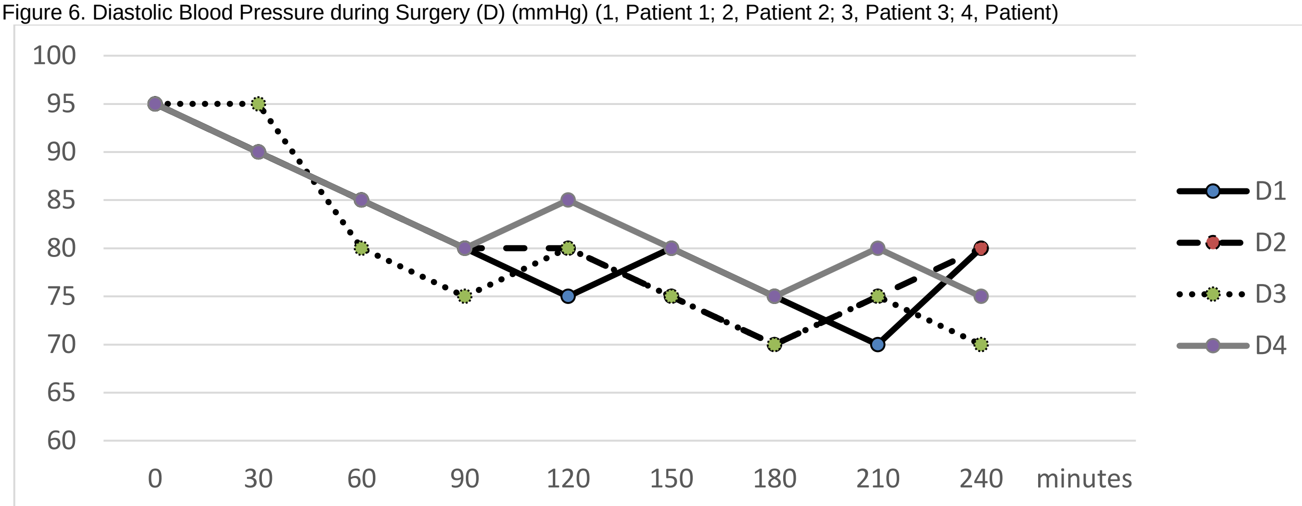

Figure 7. Heart Rate during Surgery (HR) (/minute) (1, Patient 1; 2, Patient 2; 3, Patient 3; 4, Patient 4)

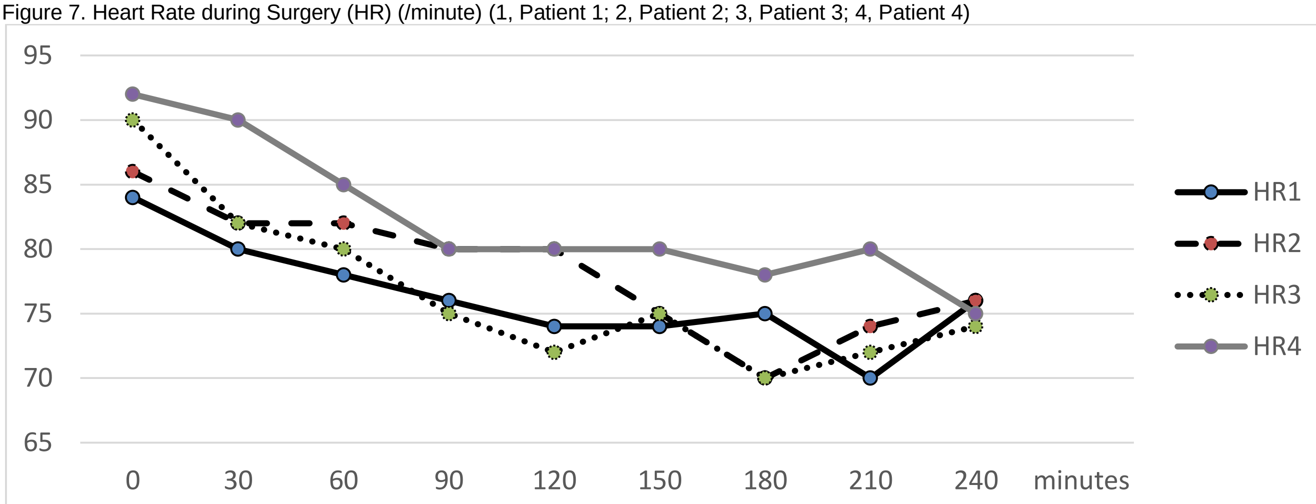

Fig 8: Systolic Blood Pressure (S) and Diastolic Blood Pressure (D) Post Surgery (1, Patient 1; 2, Patient 2; 3, Patient 3; 4, Patient 4)

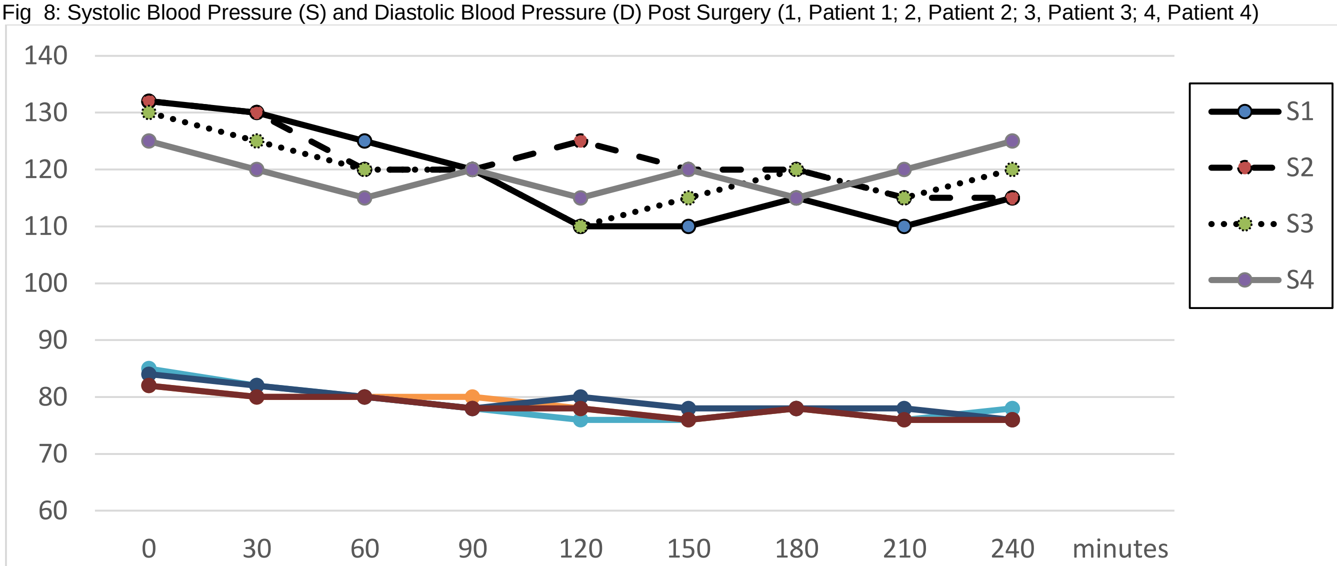

Fig. 9 Heart Rate Post Surgery (HR) (/minute) (1, Patient 1; 2, Patient 2; 3, Patient 3; 4, Patient 4)