



# Does Surgical Position Influence the Intra-abdominal Pressure During Elective Neurosurgery? A Comparison Between Prone and Lateral Surgical Position

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## INTRODUCTION

- Intra-abdominal pressure (IAP) is a steady state pressure concealed within the abdominal cavity
- Increased IAP has multiple systemic effects including raised ICP
- Different patient positions variably influence the IAP
- Both prone and lateral positions are commonly used during neurosurgery
- However, studies specifically addressing the IAP changes in prone or lateral surgical positions during neurosurgery are scarce
- We aimed at studying the IAP changes in prone and lateral positions
- **Primary Objective:** To study intraoperative IAP change in prone/lateral neurosurgical positions
- **Secondary Objective:** To study the impact of intra-operative IAP changes on post-operative hepatic and renal function, ICU stay, hospital stay and the neurological outcome

## METHODOLOGY

- Ethical committee approval taken , CTRI registration done, Consent obtained
- Forty Patients (18 to 60 years of age) of ASA I & II scheduled for elective neurosurgery in lateral or prone positions were included
- Emergency neurosurgical cases, Patients with active abdominal pathology (eg: Liver disease and kidney disease, abdominal trauma etc) and/or preoperative hepatic or renal impairment, contraindication to bladder catheterisation (eg: bladder surgery/injury, urethral strictures etc), preoperative haemodynamic instability, pregnant or morbidly obese patients were excluded
- **Monitoring:** ECG, NIBP, SPO2, CVP, IBP, UO, IAP, ETCO2, AWP, BIS®
- **Induction:** Propofol+ Rocuronium+ Fentanyl. Balanced or TIVA. BIS (40-60).
- Intra-op balanced crystalloid given as per continuously monitored PPV
- **Fluid Protocol:** Baseline @2 ml/kg/hr of balanced crystalloid. If PPV >13% for >5 min → fluid bolus over 10 min till PPV falls below 13%.
- If still MAP < 65 mm Hg → Noradrenaline to achieve MAP of >65mmHg
- NG tube inserted in all patients.
- Brain bulge graded by the operating surgeon
- Acute hemodynamic disturbances due to blood loss → blood & blood products
- Intraoperative vitals, complications, fluid intake and output, requirement of vasoactive/inotropic support, duration of anesthesia and surgery were noted
- Extubation done as per preop status and intraoperative course
- KFT, LFT, Electrolytes, ABG done immediate postop then daily for 72 hours
- AKIN staging & NGAL levels done for assessment of renal injury
- Any kidney injury or hepatic derangement was managed as appropriate
- Duration of ICU/hospital stay, neurological outcome at discharge (GOS) noted

### IAP measurement technique:

- IAP measured using intravesical pressure monitoring method (Figure 1)
- Pressure transducer was zeroed at the level of symphysis pubis in MAL
- Nasogastric tube was aspirated before the baseline IAP measurement
- IAP was measured at supine position (baseline), 15 minutes after final surgical position and then every 2hourly till skin closure
- Post- op in ICU IAP was measured every 4 hourly in supine position for next 24 hour
- In extubated Patients: IAP was measured at the end of expiration when VAS is ≤ 2
- In mechanically ventilated patients: IAP was measured ensuring a RASS of -4
- Appropriate analgesia and sedation ensured in ICU before measuring IAP to meet the above criteria.



Figure 1. Intra Abdominal Pressure (IAP) measurement

### IAH or ACS Management:

- Ruling out abdominal wall compression
- Adequate analgesia/sedation to improve thoracoabdominal muscle tone,
- Nasogastric tube decompression, , USG of abdomen
- Administration of pro-kinetic agent like metoclopramide,
- Correction of fluid balance and maintenance of MAP

## RESULTS

Table 1: Demography & Baseline characteristics

|                           | Lateral       | Prone         | p value |
|---------------------------|---------------|---------------|---------|
|                           | Mean ± SD     | Mean ± SD     |         |
| Age (years)               | 36.95 ± 13.16 | 35.20 ± 11.85 | 0.202   |
| Sex (F:M)                 | 11:9          | 9:11          | 0.896   |
| BMI (kgs/m <sup>2</sup> ) | 23.60 ± 0.91  | 23.38 ± 1.27  | 0.371   |
| ASA 1                     | 18 (90.0%)    | 17 (85.0%)    | 0.184   |
| ASA 2                     | 2 (10.0%)     | 3 (15.0%)     |         |
| Features of Raised ICP    | 4 (20.0%)     | 3 (15.0%)     | 0.825   |
| ODEMA/ MLS                | 2 (10.0%)     | 4 (20.0%)     | 0.217   |
| COMORBIDITIES             |               |               |         |
| HTN                       | 0 (0.0%)      | 0 (0.0%)      | 0.171   |
| Hypothyroidism            | 1 (5.0%)      | 0 (0.0%)      |         |
| T2 DM                     | 0 (0.0%)      | 2 (10.0%)     |         |

Table 2: Intraoperative Data

|                              | Lateral          | Prone            | P value      |
|------------------------------|------------------|------------------|--------------|
| Duration of Anesthesia (min) | 369.25 ± 14.35   | 371.6 ± 18.70    | 0.783        |
| Duration of Surgery (min)    | 320.65 ± 13.38   | 323.1 ± 23.68    | 0.812        |
| Intraoperative Events        |                  |                  |              |
| Hemodynamic alteration       | 2 (10.0%)        | 2 (10.0%)        | 1.0          |
| VAE                          | 1 (5%)           | 0 (0%)           | 0.793        |
| Blood loss (ml)              | 1007.50 ± 457.19 | 1000.00 ± 469.82 | 0.694        |
| Inotrope Requirement         | 1 (5.0%)         | 1 (5.0%)         | 1.0          |
| Volume of Crystalloid        | 4005.00±722.19   | 3675.00±754.55   | <b>0.039</b> |
| Volume of Colloid            | 575.00 ± 293.57  | 425.00 ± 293.57  | 0.166        |
| PRBC (Unit)                  | 0.75 ± 0.9       | 0.75 ± 1.02      | 0.334        |
| FFP (Unit)                   | 0.10 ± 0.45      | 0.30 ± 0.66      | 0.161        |
| PRP (Unit)                   | 0.10 ± 0.45      | 0.30 ± 0.66      | 0.161        |
| Urine output                 | 1797.50 ±457.53  | 1620.00±735.81   | 0.140        |

Table 3: Intraoperative IAP Values

|         | Lateral      | Prone        | p value          |
|---------|--------------|--------------|------------------|
|         | Mean ± SD    | Mean ± SD    |                  |
| IAP0    | 5.6 ± 1.64   | 6.7 ± 2.13   | 0.160            |
| IAP POS | 9.4 ± 2.82   | 13.25 ± 3.16 | <b>&lt;0.001</b> |
| IAP120  | 11.4 ± 1.98  | 13.4 ± 2.23  | <b>&lt;0.001</b> |
| IAP240  | 12.65 ± 1.53 | 13.35 ± 1.93 | <b>&lt;0.001</b> |
| IAP330  | 12.5 ± 1.7   | 12.9 ± 1.1   | <b>&lt;0.001</b> |

Table 4: Postoperative Data

|                      | Position         |                  | p value      |
|----------------------|------------------|------------------|--------------|
|                      | Lateral          | Prone            |              |
| POST OP EVNT         |                  |                  |              |
| Fever                | 1 (5%)           | 1 (5%)           | 0.242        |
| Neurological Deficit | 1 (5%)           | 0                |              |
| Tracheostomy         | 2 (10.0%)        | 2 (10.0%)        |              |
| Others               | 1(5%)            | 1(5%)            | 0.176        |
| VENT DAYS            | 1.35 ± 1.3       | 3.85 ± 2.40      |              |
| ICU STAY             | 3.10 ± 1.48      | 2.90 ± 1.77      | 0.013        |
| HOSPITAL STAY        | 8.80 ± 3.33      | 9.40 ± 8.26      | 0.468        |
| GOS                  | 1.35 ± 0.67      | 1.50 ± 0.83      | 0.756        |
| MEAN INTAKE (ml)     | 2486.29 ± 394.54 | 2434.83 ± 427.01 | 0.068        |
| MEAN U.O (ml)        | 1699.25 ± 368.36 | 1706.33 ± 567.53 | 0.292        |
| AKIN G1(n)           | 1(5%)            | 2 (10%)          | <b>0.031</b> |
| AKIN G2 (n)          | 0                | 1(5%)            | <b>0.002</b> |
| AKIN G3(n)           | 0                | 0                | 0.0          |

Table 5: Baseline and Postoperative Blood Parameters

|                   | Lateral       | Prone         | p value      |
|-------------------|---------------|---------------|--------------|
| UREA_BL (mg/dl)   | 28.45 ± 10.23 | 25.95 ± 6.87  | 0.764        |
| UREA postop       | 24 ± 7.91     | 25.8 ± 8.04   | 0.862        |
| Creat_BL(mg/dl)   | 0.76 ± 0.44   | 0.8 ± 0.28    | 0.598        |
| Creat_postop      | 0.65 ± 0.18   | 0.71 ± 0.2    | 0.700        |
| Na_BL (mmol/L)    | 139.05 ± 3.39 | 138.5 ± 3.3   | 0.632        |
| Na_postop         | 137.1 ± 3.66  | 136.75 ± 4.69 | 0.136        |
| K_BL (mmol/L)     | 4.08 ± 0.38   | 4.32 ± 0.59   | 0.253        |
| K_postop          | 3.84 ± 0.28   | 3.7 ± 0.36    | 0.523        |
| Cl_BL(mmol/L)     | 96.8 ± 23.18  | 105.25 ± 4.95 | 0.294        |
| Cl_postop         | 103.25 ± 4.22 | 105.95 ± 4.42 | 0.083        |
| pH_BL             | 7.4 ± 0.04    | 7.43 ± 0.07   | 0.132        |
| pH_postop         | 7.38 ± 0.05   | 7.41 ± 0.05   | 0.344        |
| LACATE_BL(mmol/L) | 1.95 ± 0.74   | 1.8 ± 0.86    | 0.955        |
| LACTATE_postop    | 1.18 ± 0.41   | 1.29 ± 0.54   | 0.735        |
| AST_BL (unit/L)   | 34.18 ± 14.43 | 35.00 ± 12.99 | 0.123        |
| AST_postop        | 36.50 ± 14.33 | 34.95 ± 19.77 | 0.900        |
| ALT_BL (unit/L)   | 44.55 ± 19.91 | 42.35 ± 19.02 | 0.107        |
| ALT_postop        | 42.20 ± 21.90 | 42.00 ± 19.23 | 0.369        |
| Serum NGAL        | 23.69 ± 19.38 | 83.52 ± 53.58 | <b>0.012</b> |

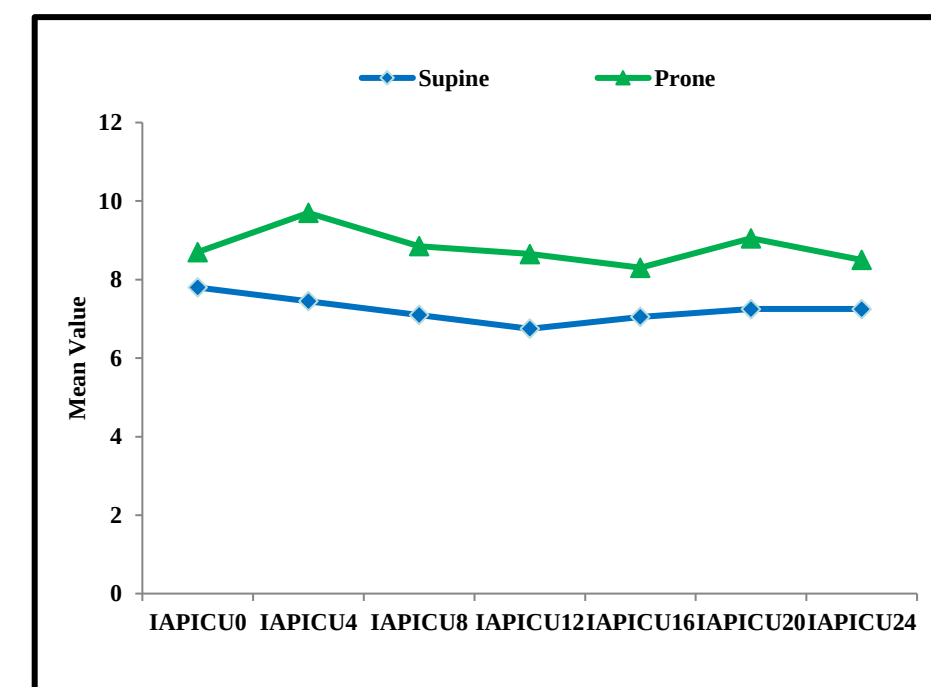


Figure 2. Postoperative IAP Values

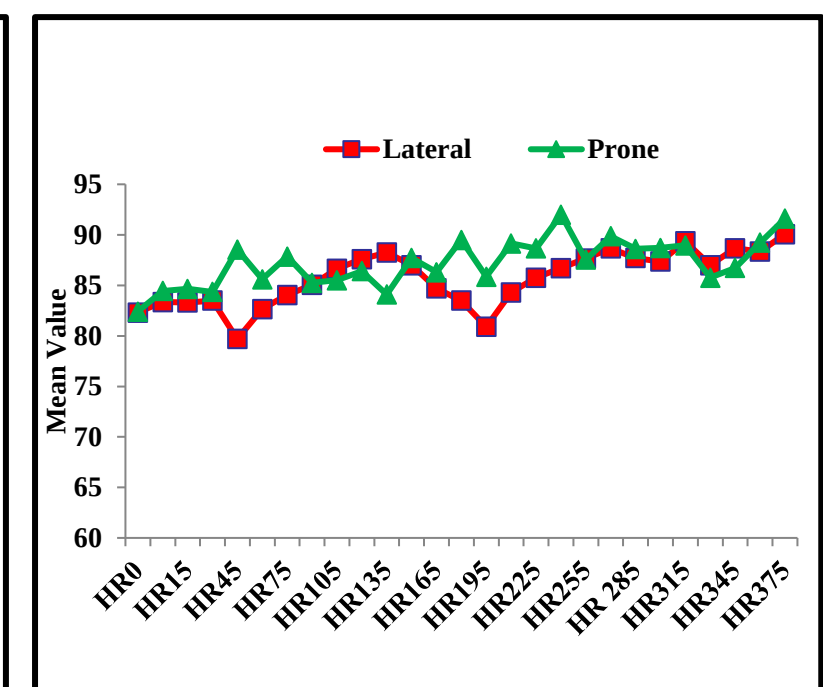


Figure 3. Intraoperative HR

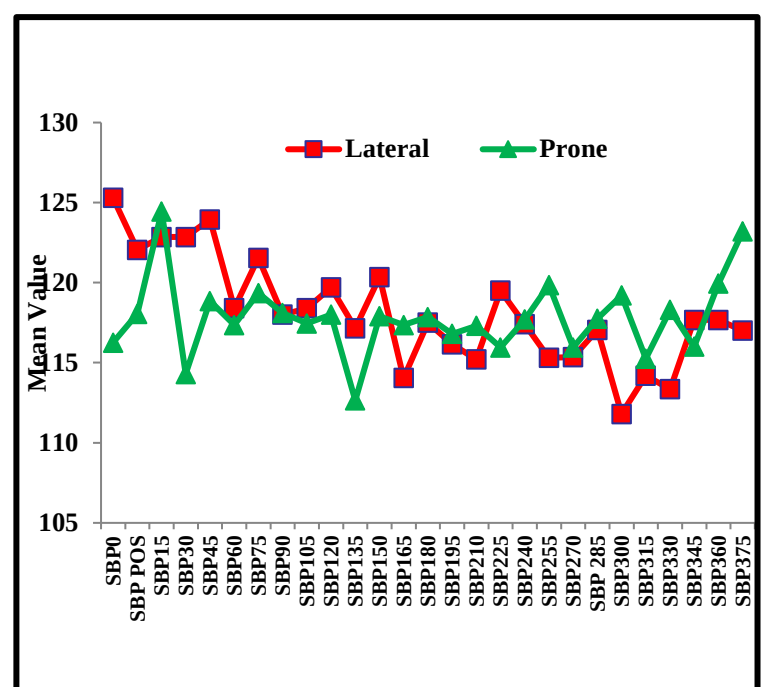


Figure 4. Intraoperative SBP

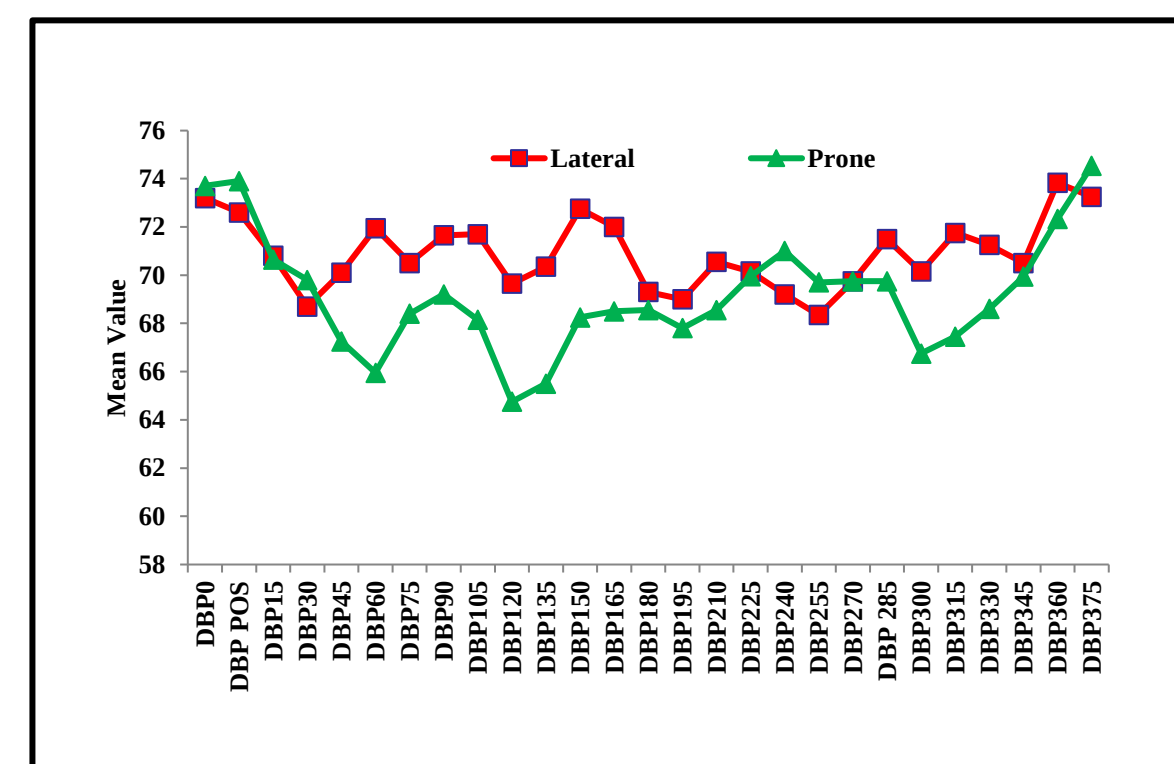


Figure 5. Intra-operative DBP

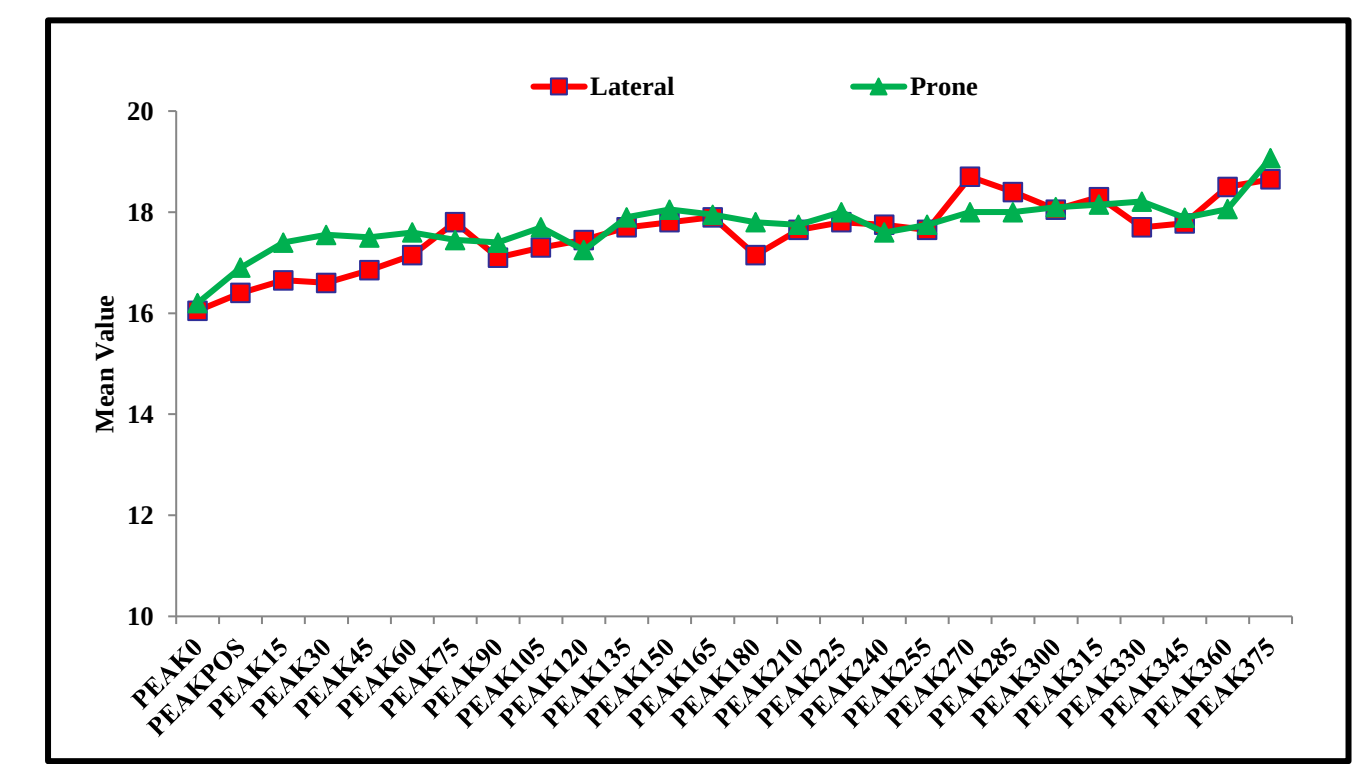


Figure 6. Intra-operative Peak Airway Pressure

## CONCLUSION

- Neurosurgical patients operated in prone position have significantly higher intra-operative and post-operative IAP values and higher incidence of AKI as compared to lateral position