INTRODUCTION

Central neuraxial blocks (CNBs) are widely practised in India and have a strong safety record. However, minor, transient, permanent or life-threatening complications may be observed following the procedure.

Incidence of major neurological complications ranges from 1:1000 to 1:100,000 CNBs according to available western literature.[1] One must know this to explain the risk of CNB and also to deal with medico-legal problems. Also, country-specific safety guidelines can be formulated if this data are available. Most of the available information is from studies conducted...
abroad and may not apply to Indian scenarios because of divergent anaesthetic practices, hospital settings, training programs and resources in the operation theatre.\textsuperscript{[1-4]}

Indian data regarding nature, incidence and outcome of neurological complications following CNB is not available. It is not possible to collect retrospective data as there is no national board to report complications following anaesthesia in India. Estimation based on case reports or retrospective studies may underestimate incidence of major neurological complications.

Major neurological complications following CNB are rare. Large patient data from prospective multicentric studies are needed to find out the incidence, and problems might be encountered during conduct of the studies.\textsuperscript{[5,6]} With this background, a pilot study is an essential prerequisite to assess feasibility of a large study.\textsuperscript{[7]}

A multicentre pilot study was conducted with the primary objective to assess the feasibility to conduct a multicentre nationwide study related to neurological complications following CNB (recruitment process, protocol adherence, resources mobilisation, data management and evaluation of scientific outcome; with special emphasis on cause and effect relationship of neurological complications with CNB).

The secondary objectives were to find out i) indications, types and frequency of CNB ii) types of local anaesthetics and adjuvants used iii) drugs used for sedation and analgesia during CNB.

**METHODS**

Investigators followed the methodology based on CONSORT 2010 extension guidelines, for this study.\textsuperscript{[8,9]} It was a hospital-based study involving tertiary care institutes (TCI) and non-tertiary care institutes (NTCI) in the city with facilities for CNB and representing infrastructure and practice diversity. The study was coordinated by Department of Emergency Medicine of MGM medical college. Administrative permissions and ethical clearance were obtained. Written informed consent and nondisclosure agreement was obtained from institutional heads, study team and participating anaesthesiologists. Patient’s consent was obtained as per standard procedure.

This was a period-based, observational, multicentre, external pilot study having two components. Component I, related to CNB profile, was a cross-sectional study. Component II, related to follow-up of complications was a prospective study. Study duration was from January 2019 to December 2020, including preplanning to report-writing period. Apart from investigators, study team comprised 22 faculty members and five advisors [Annexure 1].

Data of the patients receiving CNB were collected by anaesthesiologists from the participating institutes. Anaesthesiologists, enroled in the Indian Society of Anaesthesiologists city branch, were approached telephonically and the study purpose was explained. Details of study were e-mailed to seek willingness to participate. 50% of willing TCIs and NTCIs were selected using simple random sampling (sealed envelope method) by coordinators. A meeting was organised at the coordinating site to explain study procedure. Multilingual patient information brochures and consent forms were provided. Study coordinators allotted code numbers to institutes to collect data anonymously. Anaesthesiologists explained the purpose of study before obtaining consent from patients. In addition, an information brochure was provided to patients.

Inclusion criteria were Indian patients willing to participate by giving written informed consent, from all age groups (including paediatric age group), genders and receiving CNB (spinal, epidural, combined spinal/epidural, caudal block) during perioperative period, for acute and chronic pain management, for obstetric analgesia or obstetric analgesia and anaesthesia.

Patients receiving intravenous (I.V.) analgesics, narcotics, anxiolytics, or ketamine in analgesic doses (up to 0.5 mg/kg) during CNB and patients receiving repeat spinal/epidural anaesthesia were included in the study.

Exclusion criteria were patients receiving CNB combined with general anaesthesia. Patients in whom neuraxial block could not be administered due to technical difficulty or general anaesthesia was administered for failed block were also excluded.

This study was not intended to calculate sample size for future large-scale studies and to test any hypothesis. Sample size was not calculated for this pilot study.\textsuperscript{[7]} This was a period-based observational study. Data of 8053 patients were collected over 7 months from May 1 to November 30, 2019.
Investigators and coordinators had unanimously agreed to collect data till the desired endpoints were achieved - a) reporting of at least one major neurological complication and its follow-up period along with audit committee analysis period. b) Data uploading by more than 90% of anaesthesiologists without repeated reminders.

There were three tools for CNB profile, feasibility and suggestions.

CNB profile tool (Tool I) included three Google forms (A, B, C). Form 'A' was for collecting coded information regarding patient demographics, type and indication of CNB, local anaesthetics, adjuvant, I.V. analgesics/ sedatives used. Form 'B' was for reporting neurological complication. Form 'C' was for monthly follow-up of patient developing a complication till 6 months or till death, whichever was earlier. Tools for feasibility assessment (Tool II) included semi-structured feedback collected anonymously by principal investigator from participants to assess feasibility of study protocol and data uploading (patient recruitment, time required and convenience) via online pretested questionnaire. Tools III was for collecting suggestions from participating anaesthesiologists and study team members.

Data were collected online. Anaesthesiologists were instructed to upload data through Google forms link provided by investigators. Weekly reminders were sent to anaesthesiologists from coordinators. Data operators sent defaulters’ information to coordinators for additional reminders. The anaesthesiologists who required repeated reminders (four or more personal calls/month) were noted by coordinators. Anaesthesiologists were requested to communicate the number of eligible patients refusing to answer the coordinator. If a patient had any major neurological complication, the concerned anaesthesiologist requested coordinator for forms 'B' and 'C'. These coded forms were forwarded to the principal investigator, who directed them to audit committee. The audit committee submitted complication analysis to the principal investigator.

Data were stored in an encrypted computer located in Emergency Medicine department. Consent forms and data would be preserved as per statutory guidelines.

Clinical outcome and feasibility criteria were defined a priori for a large study. Major neurological complications included were epidural abscess, bacterial meningitis, vertebral canal haematoma, paraplegia/quadriplegia, major neuropathy, wrong drug/route administration, cardiac arrest where anaesthetic/analgesic procedure was responsible for arrest as defined by Cook et al.[1] Neurological injury was labeled as permanent when neurological symptoms persisted beyond 6 months.[9]

A large study would be possible if study protocols were adhered to: ≥70% of all eligible patients could be recruited, ≥90% of anaesthesiologists uploaded data without repeated reminders and complete data uploading of ≥90% of all recruited subjects. Reporting and analysis of all patients developing complications and their follow-up should be possible in 95% of patients for 95% of the predecided follow-up period.[10,11] Financial and human resources feasibility problems could be identified from feedbacks.

Data were extracted from Google forms in the form of MS Excel 2010. It was cleaned, coded and analysed using Statistical Package for the Social Sciences version 25 (International Business Machines USA, 2020). Quantitative data were reported as absolute numbers and percentages. Means and standard deviations were calculated wherever necessary. Chi-square test was applied and $P$ value < 0.05 was considered significant. The feasibility and audit data were analysed separately.

The measures adopted for quality assurance of the present study were the consultation with subject experts from and outside India; legal advice by advocate; appointment of 22 study team members [Annexure 1], blinding of investigators and audit committee members; anonymous data entry and regular reminders by coordinators [Annexure 2].

**RESULTS**

Anaesthesiologists from all TCIs (06) and NTCIs (89) were approached. About 23 (25.85%) anaesthesiologists from NTCIs were not willing to participate for various reasons. All anaesthesiologists from 06 TCI and 66 anaesthesiologists (74.15%) from NTCI were willing to participate. As there was no similar study conducted in India, considering assumption of response distribution of 50%, anaesthesiologists from 03 TCI and 33 NTCI were selected for the study. All anaesthesiologists continued participation throughout the study period. TCI and NTCI contributed for mean 2002 and 61 patients respectively. (TCI:NTCI enrolment proportion was...
32.81:1 and the difference was not statistically significant, $P = 0.15$). The feasibility assessment was analysed. About 8087 (99.98%) eligible patients were enrolled. Excluding patients receiving general anaesthesia (34 patients), data of 8053 patients were analysed [Figure 1].

Investigators adhered to the study protocol. Daily data uploading was feasible but 16.2% of the participants uploaded data only after repeated reminders, due to unavoidable reasons and the large patient load of TCIs, at times. Hence, all anaesthesiologists were permitted to upload data at any time in that particular week. However, the coordinator’s timely reminders were sent to ensure feasibility target. Six anaesthesiologists were allowed to upload backdated data of the previous month as they had technical or health-related problems. Apart from these minor modifications, the study protocol was strictly adhered to. Financial grant was approved by the sponsoring university. Infrastructure was provided by the coordinating institute.

A robust study team of 22 faculty members could conduct the study smoothly. However, anaesthesiologists from TCI requested additional manpower for data entry.

Feasibility feedback from anaesthesiologists, investigators, coordinators and auditors was analysed [Table 1]. Complete data of all recruited patients (100%) was uploaded, stored and analysed. TCI contributed to 74.50% of patient data in which 64.96% of the total participants were female. Out of 8053 patients, 3836 (47.63%) were females in the age group of 21-40 years and 12.56% patients were in the age group of 0–20 years [Table 2]. CNB was administered in 93.63% of patients for perioperative procedures. Acute pain management in the form of obstetric analgesia alone and analgesia converted to obstetric anaesthesia was used more in NTCI patients than TCI patients. Epidural block was used for chronic pain management in 0.13% of patients [Annexure 3].

Spinal anaesthesia was the most frequently (93.41%) used CNB in TCI and NTCI. Combined spinal-epidural was used in more patients from TCI (391 patients) and caudal was practised only from NTCI [Table 3]. Bupivacaine was used in 95.53% of patients. Five percent lignocaine was used (75-100 mg) by six anaesthesiologists. Newer local anaesthetics like ropivacaine, chloroprocaine and L-bupivacaine were used less frequently than lignocaine [Table 4]. Adjuvant was not used in 78.88% patients. Fentanyl was used most frequently. Adrenaline was used in 3 patients [Annexure 4].

About 66.93% patients (57.06% TCI and 9.87% NTCI) did not receive any I.V. supplementary drug. Midazolam (15.49%) and fentanyl (2.50%) were commonly administered. Diazepam, phenergan, tramadol, pentazocine, nalbuphine, ketamine, diclofenac and dexmedetomidine were also used.

Two patients had cardiac arrest related to CNB and were followed till death. As the second complication occurred during study period, it was also analysed. Audit committee members unanimously opined about cause-effect relationship with CNB in both events [Table 5].

**DISCUSSION**

Our study is the first of its kind in India, demonstrating that a large multicentre study of major neurological complications following CNB is feasible. It was successfully conducted in 36 institutes having divergent anaesthetic practices, hospital settings and resources available in the operation theatre; hence it truly represented the CNB scenario practised in the city.

We could adhere to the study protocol with minor deviations. We were able to collect online data with the help of timely reminders by the coordinators. Anaesthesiologists uploaded complete data of all recruited patients (100%). Our online tools were user-friendly and structured in such a way that all
information was mandatory for data uploading. Statistical analysis can be biased when more than 10% of data is missing. Anaesthesiologists did not hesitate to report the complications as data collection was anonymous. Follow-up of patients who developed cardiac arrest and establishment of cause–effect relationship with CNB was possible. We also generated financial and human resources. In the past, pilot studies were completed with limited or no funding.\textsuperscript{[12]} We were able to convince the sponsoring agency for financial grant about the importance of the pilot study.

Quantitative data analysis revealed that out of 8053 patients, 47.7% females were in the age group of 21-40 years and this might have been because CNB was administered frequently for caesarean section.\textsuperscript{[13,14]} About 12.45% patients less than 20 years

\begin{table}
\centering
\caption{Feasibility Criteria and Feasibility of a Large Scale Study}
\begin{tabular}{|c|c|c|c|}
\hline
Feasibility criteria & Expected & Results of the pilot study & Large scale study Feasibility \\
\hline
1 Recruitment & & & \\
Participation of Institutes/Anaesthesiologists & 70% & 100% TCI* and 76.41% NTCI\textsuperscript{†} Anaesthesiologists & Feasible \\
Recruitment of eligible patients & 70% & 99.98% & Feasible \\
\hline
2 Data Management & & & \\
Complete Data uploading & 90% & 100% & Feasible with timely reminders \\
Data uploading was user friendly & 90% & 97.3% & Feasible \\
Time taken for uploading information/patient & 3 minutes\textsuperscript{‡} & 3-5 min. Time consuming for large data of TCI & Feasible. Data entry operator is needed for TCI \\
Data uploading complications, analysis and follow-up & Reporting 100%, follow-up 90% patients & 100% & Feasible \\
\hline
3 Resources & & & \\
Financial and infrastructure resources & Funds for computer and payment for Data operator may not be generated for a pilot study. Coordinators and Different study committee members are essential. & Financial aid Feasible Teamwork and Coordinators played a vital role & Feasible \\
Additional Human Resources & & & Feasible \\
\hline
4. Management & & & \\
Participants (Anaesthesiologists) & 90% of anaesthesiologists will upload data & 97.3%, Contribution of Anaesthesiologists practicing Super speciality was less & Feasible \\
Reporting complications by participants, follow-up and analysis, & Skeptical about complication reporting and analysis with online tools. & All patients developing Complications were reported, followed, and analysed by audit committee members & Feasible (complication reporting, follow-up and Analysis) \\
\hline
5. Scientific Outcome & & & \\
Adequacy of data collection and analysis & Skeptical about collecting sufficient evidence to demonstrate the feasibility and cause-effect relationship of CNB complication & Data of 8053 patients' CNB profile and two major complications were collected. Analysis of complications was possible & Large scale study is Feasible \\
\hline
\end{tabular}
\textsuperscript{*TCI: Tertiary care institutes, \textsuperscript{†}NTCI: Non-tertiary care institutes, \textsuperscript{‡}This was an observation of the protocol review committee, CNB: Central neuraxial block}
\end{table}

\begin{table}
\centering
\caption{Demographic Data of Patients}
\begin{tabular}{|c|c|c|c|c|c|c|c|c|}
\hline
Age Group & Female (Number of patients) & & & & Male (Number of patients) & & & \\
& TCI & NTCI & Total & & TCI & NTCI & Total & & \\
\hline
0-10 & 6 & 4 & 10 & & 12 & 25 & 37 & & \\
11-20 & 626 & 66 & 692 & & 225 & 48 & 273 & & \\
21-30 & 2315 & 852 & 3167 & & 416 & 105 & 521 & & \\
31-40 & 389 & 280 & 669 & & 413 & 111 & 524 & & \\
41-50 & 177 & 88 & 265 & & 333 & 101 & 434 & & \\
51-60 & 120 & 38 & 158 & & 266 & 93 & 359 & & \\
61-70 & 141 & 41 & 182 & & 332 & 95 & 427 & & \\
Above 70 & 67 & 22 & 89 & & 159 & 87 & 246 & & \\
\hline
Total (%) & 3841 (47.69%) & 1391 (17.27%) & 5232 (64.96%) & & 2160 (26.82%) & 661 (8.22%) & 2821 (35.04%) & & 8053 (100.00%) & \\
\hline
\end{tabular}
\textsuperscript{TCI: Tertiary care institutes, NTCI: Non-tertiary care institutes}
\end{table}
of age received CNB. Inexperience in paediatric CNB and misconceptions might be the reason for the less numbers.\textsuperscript{15,16} Spinal anaesthesia was the most commonly administered CNB. Bupivacaine was administered in 95.53% patients and fentanyl was the adjuvant of choice as observed in other studies.\textsuperscript{1,17} Five per cent lignocaine (75-100 mg) was used more frequently than ropivacaine, chloroprocaine and L-bupivacaine. Awareness about the use of safer agents for spinal anaesthesia needs to be reinforced.\textsuperscript{18} Persuasion by anaesthesiologists is essential for availability of safer local anaesthetic agents in the institutes. Obstetric analgesia and anaesthesia were used in more NTCI patients than TCI as also observed by Narayanappa et al.\textsuperscript{19}

Our pilot study demonstrated that a large multicentre study is feasible as all the feasibility criteria were

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**Table 3: Age Group and Type of CNB**

| Age Group | Caudal Anaesthesia | Epidural Anaesthesia | Spinal Anaesthesia | Combined Spinal Epidural Anaesthesia | Total Number (%) |
|-----------|---------------------|----------------------|--------------------|-------------------------------------|------------------|
| TCI       | NTCI                | Total                | TCI                | NTCI                | Total            | TCI | NTCI | Total            |
| 0-10      | 0                    | 14                   | 14                 | 0                    | 0                | 14  | 0    | 14 (0.17%)      |
| 11-20     | 0                    | 0                    | 0                  | 6                    | 3                | 9   | 1    | 699 (8.68)      |
| 21-30     | 14                   | 30                   | 44                 | 817                  | 111              | 928 | 28   | 965 (11.98)     |
| 31-40     | 11                   | 2                    | 13                 | 700                  | 387              | 1087| 91   | 1193 (14.81)    |
| 41-50     | 9                    | 3                    | 12                 | 435                  | 181              | 616 | 66   | 699 (8.68)      |
| 51-60     | 4                    | 3                    | 7                  | 339                  | 123              | 462 | 43   | 517 (6.41)      |
| 61-70     | 7                    | 2                    | 9                  | 394                  | 129              | 523 | 72   | 609 (7.56)      |
| Above 70  | 9                    | 1                    | 10                 | 188                  | 104              | 292 | 29   | 335 (4.15)      |
| Total     | 0                    | 14                   | 14                 | 60                   | 44               | 104 | 391  | 8053 (100%)     |

**Table 4: Local Anaesthetic Agents used in Tertiary Care Institutes and Non-Tertiary Care Institutes**

| Local Anaesthetic | TCI (No. of patients) | NTCI (No. of patients) | Total (No. of patients) |
|-------------------|------------------------|------------------------|-------------------------|
| Bupivacaine       | 5702 (70.80%)          | 1991 (24.72%)          | 7693 (95.53%)           |
| Bupivacaine and lignocaine | 273 (3.39%)           | 30 (0.37%)             | 303 (3.77%)             |
| Lignocaine (5% Hyperbaric) | 13 (0.16%)           | 14 (0.17%)             | 27 (0.33%)              |
| Chloroprocaine    | 1 (0.012%)             | 10 (0.12%)             | 11 (0.13%)              |
| L-Bupivacaine     | 8 (0.099%)             | 6 (0.074%)             | 14 (0.19%)              |
| Ropivacaine       | 3 (0.037%)             | 1 (0.012%)             | 4 (0.050%)              |
| L-Bupivacaine and lignocaine | 1 (0.012%)           | 0 (0%)                 | 1 (0.012%)              |
| Total no. of Patients | 6001 (74.52%)         | 2052 (25.48%)          | 8053 (100%)             |

**Table 5: Major neurological complications analysed by the Audit Committee**

| Complication observed | *Cause and effect relation with CNB | Measures suggested for prevention |
|-----------------------|-------------------------------------|----------------------------------|
| Cardiac arrest after repeat spinal anaesthesia | Event: Total spinal anaesthesia resulted after repeat spinal anaesthesia as dose of local anaesthetic exceeded the recommended dose. There was delay in recognition of total spinal anaesthesia. Outcome: Patient had cardiac arrest and hypoxic cerebral injury. Expired on 13\textsuperscript{th} day due to ventilator-associated pneumonia. CNB was responsible for cardiac arrest | Possibility of total spinal anaesthesia after repeat spinal anaesthesia should be anticipated. Early recognition of total spinal anaesthesia by continuous and vigilant monitoring of vital signs including altered consciousness and immediate treatment with head-low position, administration of fluids and vasopressors along with ventilation with 100% Oxygen can prevent cardiac arrest |
| Cardiac arrest after combined Spinal- epidural anaesthesia (ASA II)* | Event: Large epidural bolus dose of local anaesthetic for maintenance of anaesthesia during combined spinal- epidural anaesthesia was responsible for severe hypotension. Adequacy of oxygenation could not be assessed in the patient in lateral position. Pulse Oximeter readings were not of help due to hypotension. Patient had cardiac arrest. Outcome: The patient was revived but again arrested in the intensive care unit after 40 min. CNB was responsible for cardiac arrest | Titrate level of the block by giving small incremental doses of epidural rather than administering a large bolus during maintenance with epidural anaesthesia during combined spinal-epidural block. Immediate treatment with vasopressors, fluids and adequate oxygenation can be life saving |

CNB: Central neuraxial blockade, ASA: American Society of Anaesthesiologists * This patient (52 years) had a well controlled hypertension and was receiving atenolol 50 mg and amlodipine 5 mg BD. Electrocardiogram and Echocardiogram of the patient were normal.
satisfied and we could analyse the quantitative data. Yeung et al.\textsuperscript{[11]} followed similar feasibility criteria and concluded that a large study related to paravertebral and epidural block was possible. Choi et al.\textsuperscript{[10]} in their study could not satisfy feasibility criteria related to perioperative effects of epidural blockade and concluded that a large study would not be feasible.

In a pilot feasibility study related to supraglottic airway assisted fibreoptic intubation, the authors assessed only the success criteria but participants’ acceptability for study protocol was not assessed.\textsuperscript{[20]} Feasibility criteria were not decided \textit{a priori}. These parameters are mandatory for planning a large study\textsuperscript{[21,22]} and were considered in the current pilot study.

In the present study, two patients had cardiac arrest. The details of cause–effect relationship of complication and CNB are explained in Table 5. Cardiac arrest due to total spinal anaesthesia is preventable. Extra vigilance is required when repeat spinal anaesthesia is administered, as there is an increased risk of high spinal anaesthesia.\textsuperscript{[23]} Early recognition and treatment are essential.\textsuperscript{[24]} Epidural top-ups of local anaesthetic should be given in small incremental doses.\textsuperscript{[25]}

Coordinated teamwork was the key factor for smooth conduct of the current study. Pilot studies help to increase the validity and reliability of a future large study.\textsuperscript{[26,27]} It will not be appropriate to estimate the incidence of complications from our study as major neurological complications following CNB are rare and large sample size is needed for the same.\textsuperscript{[27]} Data of patients developing complications might be missed if the patient did not report to the anaesthesiologist. This is a limitation of our study.

**CONCLUSIONS**

We conclude that it is possible to conduct a nationwide study using our pilot study protocol, with close monitoring of data uploading. A large multicentre study is required to find out the incidence and outcome of major neurological complications following CNB. This nationwide data can be used to prepare Indian guidelines for safer use of CNB and to address medico-legal issues following complications. Information of true risk associated with the use of CNB will help patients to make an informed choice of anaesthesia.

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The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Mahatma Gandhi Mission Institute of Health Sciences, Navi Mumbai (Deemed University).

**Conflicts of interest**

There are no conflicts of interest.

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CNB STUDY (ANNEXURE 1)

Study Team Members
MGMA CNB Study Team Members (Annexure 1)

Advisors:

| Name                  | Designation                      | Institute                                           |
|-----------------------|----------------------------------|-----------------------------------------------------|
| Dr. Mohan Rajapurkar  | Director, Post Graduate Studies & Research, Senior Nephrology Consultant | Mulji Patel Urological Hospital, Nadiad             |
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Audit Committee Members:

| Name                      | Designation                          | Institute                                      |
|--------------------------|--------------------------------------|------------------------------------------------|
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| Dr. Shubhangi V. Shetkar | Senior Radiologist                   | Mangal Medi Centre, Aurangabad                |

Adjudication Committee Members:

| Name                      | Designation                  | Institute                                      |
|--------------------------|------------------------------|------------------------------------------------|
| Dr. Anirudha D. Gulanikar| Professor, Dermatology       | MGM Medical College, Aurangabad                |
| Dr. Sachin S. Kale       | Professor and Head, Pathology | MGM Medical College, Aurangabad                |
| Dr. Sangita R. Phatale    | Professor, Physiology        | MGM Medical College, Aurangabad                |
| Dr. Deepali M. Vaishnav   | Professor, Biochemistry      | MGM Medical College, Aurangabad                |
| Dr. Bhavana P. Joshi     | Assistant Professor, Community Medicine | MGM Medical College, Aurangabad               |

Study Assistant:

| Name           | Department               | Institute                                      |
|----------------|--------------------------|------------------------------------------------|
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**CNB STUDY (ANNEXURE 3)**

### Indications for Central neuraxial block (CNB)

Obstetric analgesia and obstetric analgesia extended to anaesthesia was used in more patients of TCI than NTCI. This was the only modality of acute pain management.

| Type                        | TCI   | NTCI  | Number of patients | Percentage of patients* |
|-----------------------------|-------|-------|--------------------|-------------------------|
| Perioperative CNB           | 5825  | 1715  | 7540               | 93.63%                  |
| Obstetric analgesia         | 90    | 69    | 159                | 1.97%                   |
| Obstetric analgesia and     | 78    | 264   | 342                | 4.24%                   |
| anaesthesia                 |       |       |                    |                         |
| Chronic pain management     | 8     | 4     | 12                 | 0.13%                   |
| Total                       | 6001  | 2052  | 8053               | 100%                    |

*Percentages are calculated column-wise.

- TCI: Tertiary Care Institute; NTCI: Non-Tertiary Care Institute

**CNB STUDY (ANNEXURE 4)**

Adjuvant was used more in patients of TCI whereas Buprenorphine was used more in NTCI patients. Adrenaline was used in only three patients.

| Adjuvant used with Local Anesthetic | TCI   | NTCI  | Total number of patients | Total percentage of patients |
|-------------------------------------|-------|-------|--------------------------|----------------------------|
| Not received any adjuvant           | 4624  | 1730  | 6353                     | 78.88%                     |
| Fentanyl                            | 1082  | 253   | 1335                     | 16.5%                      |
| Clonidine                           | 260   | 46    | 306                      | 3.9%                       |
| Buprenorphine                       | 29    | 23    | 52                       | 0.65%                      |
| Adrenaline                          | 3     | 0     | 3                        | 0.037%                     |
| Triamcinolone*                      | 3     | 0     | 4                        | 0.037%                     |
| Total                               | 6001  | 2052  | 8053                     | 100%                       |

*Triamcinolone was used with Bupivacaine for Chronic backache management