

# Ultrasound in Pain and Musculoskeletal Interventions: A Nation-wide Survey of Practicing Pain Physicians

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## Abstract

**Background:** Conventionally, fluoroscopy has been used by Pain Physicians to perform minimally invasive pain and spine interventions. In recent times, the use of ultrasound (US) in interventional pain management (IPM) has increased significantly. However, there is no Indian data with regard to US use for IPM. Hence, the musculoskeletal (MSK) pain special interest group (SIG) of the Indian Society for Study of Pain (ISSP) decided to conduct a survey among Indian Pain Physicians to get an insight into various aspects of US in IPM. **Materials and Methods:** The MSK Pain SIG of ISSP developed the questionnaire, and the same was sent to ISSP members with an active E-mail ID. The questionnaire was mainly about US availability at the workplace, training received for US-guided IPM, barriers to US use, and suggestions to improve widespread US use. **Results:** The response rate was only 15% (176 out of 1160 physicians responded). The majority (69.3%) of the respondents used both US and fluoroscopy and the US machine was available in 76.1% pain clinics. Over three-fourth reported that they have received training for US-guided IPM. Only half of the participants expressed that they received US training during pain fellowships. Barriers for US use included lack of formal teaching/training of US, availability of US machine, and preconception and prenatal diagnostic techniques (PCPNDT) act. The future strategy includes taking measures for US availability for pain physicians, mandatory US training during fellowships and regular workshops. **Conclusion:** This first-of-its-kind survey provides many valuable insights on US availability, barriers, and future suggestions. ISSP can consider joint collaboration with other organizations on dilution of existing law and take measures to improve US training and its widespread use.

**Keywords:** Indian Society for Study of Pain, minimally invasive pain and spine interventions, national survey, pain management, ultrasound, ultrasound-guided interventional pain management

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## INTRODUCTION

Conventionally, minimally invasive pain and spine interventions (MIPSI) for managing chronic pain have been performed under **fluoroscopic (FL)** guidance. However, ultrasound (US)-guidance is gaining acceptance for MIPSI as an alternative.<sup>[1-3]</sup> US in regional anesthesia and acute pain management has become a standard technique and has almost replaced neurostimulation in many places;<sup>[4,5]</sup> however, the application of US in chronic pain management remains underutilized.<sup>[6]</sup> US provides distinct advantages, including no radiation exposure, portability, low cost, appreciation of drug spread, and avoidance of injury to surrounding unintended structures.

Indian Society for Study of Pain (ISSP) has formed a few special interest groups (SIGs) in recent times, and musculoskeletal (MSK) Pain SIG is one of them. The SIGs have been at the forefront in formulating Indian guidelines and protocols to make procedures and treatments uniform throughout the country. One of the exercises MSK Pain SIG undertook was conducting a survey among Indian

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pain physicians to get first-hand knowledge on US use in interventional pain management (IPM), barriers to its use, and suggestions from members to increase widespread use of US.

## METHODS

A questionnaire was developed by all the members of ISSP MSK Pain SIG. Questions were designed to get information on the duration of pain practice, imaging modality of IPM, availability of US at the workplace, training obtained, adequacy of training, barriers to US use, and suggestions to improve US education [Appendix 1]. After approval of the questionnaire, an anonymous survey was conducted among the active ISSP members via E-mail. The survey was conducted between November 10, 2018, and February 10, 2019. The ISSP database had names of 2020 members, of which 1160 members had an active E-mail ID when the study was conducted. The survey questionnaire was sent to those 1160 members over E-mail with a link to answer the questionnaires. Members were reminded several times to complete the survey.

## RESULTS

The questionnaire was sent to a total of 1160 member physicians having an active E-mail in the database, and the response rate was around 15% ( $n = 176$ ).

### AQ4 Type of pain clinic [Figure 1a]

Among the respondents, 46% were working in an academic center/institution-based pain clinic, whereas 27.9% and 26.1% of physicians were working in the corporate hospital and private/self run pain clinics, respectively.

### AQ4 Duration of pain practice [Figure 1b]

Similarly, 46% of physicians responded that they were practising pain medicine for 1–5 years, followed by 26.1% of physicians practising for 5–10 years, 18.2% practising for >10 years, and 9.7% physicians practising for <1 year.

### AQ4 Imaging used for pain interventions [Figure 2a and b]

Image guidance is an essential part of IPM. Our survey revealed that more than two-thirds (69.3%) physicians used both US and fluoroscopy, whereas 20.5% and 7.4% physicians used only fluoroscopy and US, respectively. Surprisingly, 2.8% of physicians did not use any imaging modality for carrying out IPM.

More than three-fourth of the respondents (76.1%) had US machines available for pain interventions.

### AQ4 Training for ultrasound-guided interventional pain management [Figure 3a and b]

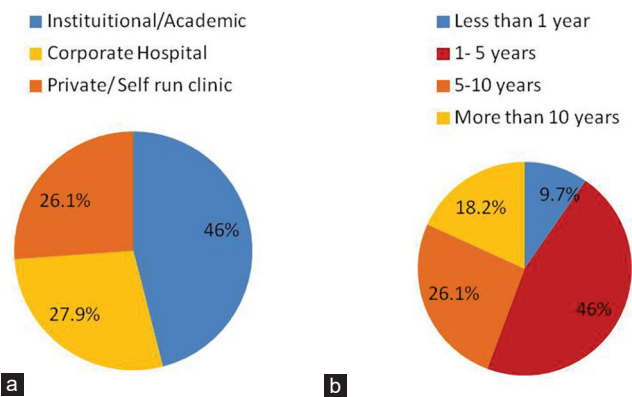
Although more than three-fourth of the respondents underwent US training for IPM, only 43.8% felt that their US training was adequate.

This question on the source of training for US had multiple options and the physicians were given the choice of choosing more than one option. Hence, there was a mixed response, as

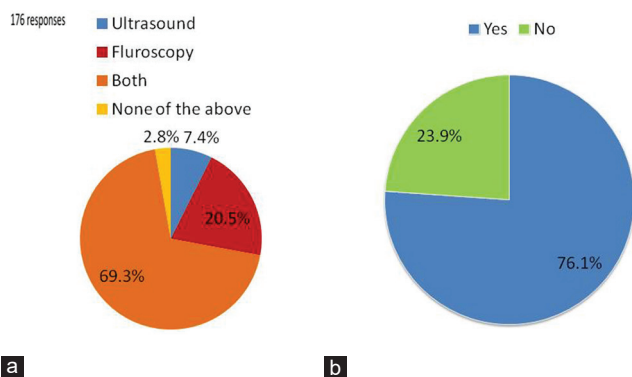
many of the physicians used various resources for US learning. The majority of respondents (80.1%) learned from various workshops, followed by Internet (59.7%) and textbook or journals (55.7%). Half of the physicians obtained US-guided pain interventional training during their fellowship [Figure 4].

### Barriers to ultrasound learning and Use [Figure 5]

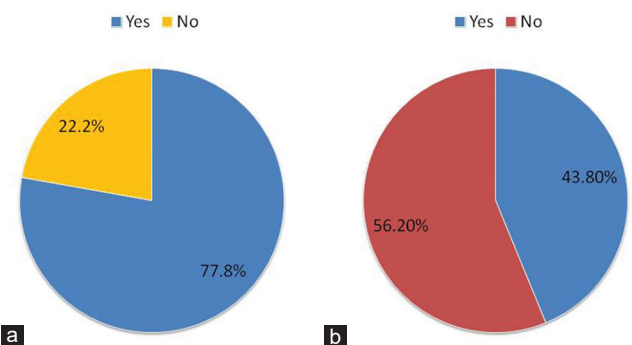
This was also a multiple choice question with the choice of opting for more than one option. The most common barrier was no formal teaching of US during residency (59.1%),



**Figure 1:** (a) Percentage of respondents working in different type of pain clinics. (b) Duration of pain practice in years and expressed as percentage



**Figure 2:** (a) Different imaging used for interventions and expressed in percentage. (b) Availability of ultrasound in pain clinics



**Figure 3:** (a) Percentage of physicians having ultrasound training. (b) Physicians' response of adequate ultrasound training; expressed as yes or no

followed by nonavailability of the US machine (54.5%), PCPNDT Act (48.3%), and lack of the adequate number of properly trained physicians (45.5%). One-third and one-fourth of the respondents opined that lack of proper training during pain fellowship and too much emphasis on fluoroscopy, respectively, were potential barriers.

### Suggestions for improving ultrasound education and widespread use in interventional pain management [Figure 6]

This questionnaire contained three options with the choice of opting for as many as appropriate. Majority of the physicians (81.3%) opined that universal availability of the US machine was required. The other recommendations were to conduct regular CME and workshops on US (67.1%) and emphasis on US teaching in all fellowship/training centers across the country (60.8%).

### Performance of various interventional procedures under ultrasound

The responses for various interventions were categorized into different regions (e.g. Craniofacial, cervical, thoracic, lumbosacral, sympathetic peripheral nerve, and joints) and are presented in Tables 1 and 2. It is evident that the commonly performed US-guided procedures are peripheral nerve blocks such as occipital nerve, intercostals nerve, ilioinguinal nerve, suprascapular nerve, and lateral femoral cutaneous nerve block followed by joint injections.

## DISCUSSION

Percutaneous image-guided interventions form an integral part of IPM. Conventionally, interventions were performed with either landmark or image-guided techniques, including fluoroscopy (FL) and computed tomography. However, in the last decade, there has been significant interest and growth of US use in IPM, given its benefit of real-time visualization of structures and needle advancement, injectate spread, low cost, portability and no radiation exposure to the health-care provider and the patient.<sup>[2,6]</sup> US application in IPM involves three major areas: axial structures such as spines, peripheral nerves, and MSK structures such as joints, bursae, muscles, ligaments, and tendons. It has an unparalleled advantage in MSK and peripheral nerve interventions and at the same time, more papers are being published on US utility in axial structures like spine and sympathetic blocks.<sup>[7-10]</sup> Other advantages include its utility for bedside procedures in morbid cancer pain patients for peripheral nerve and sympathetic blocks.<sup>[11]</sup> It is often argued that FL is the best imaging modality in detecting the intravascular spread after dye injection, but it is well proven that US not only detects but also prevents an intravascular injection.<sup>[12]</sup> Hence, it is imperative to learn US-guided interventions to keep abreast with the technology and utilize numerous advantages of this imaging modality. Despite numerous advantages, US use in IPM is not widespread for various reasons. For the novices, there is a great amount of learning curve with US, and another

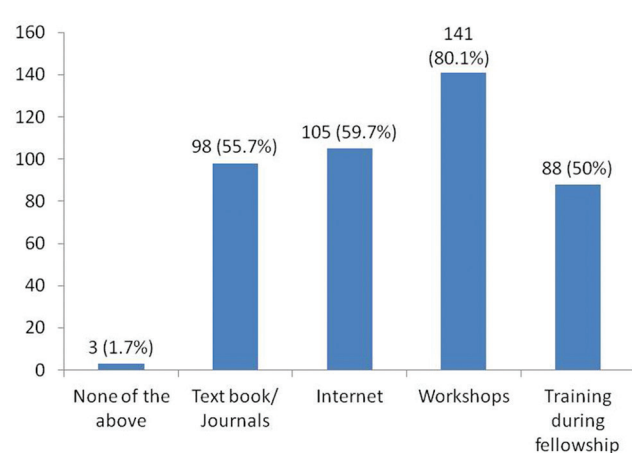


Figure 4: Various resources used by physicians for ultrasound knowledge

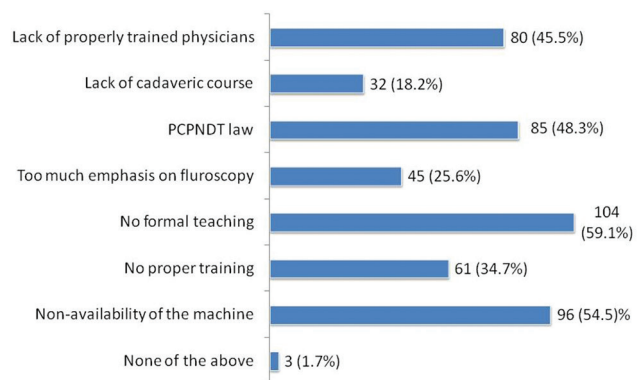


Figure 5: Barriers and challenges to ultrasound use, expressed as percentage

### What can be done by ISSP to improve USG use in Pain medicine intervention?

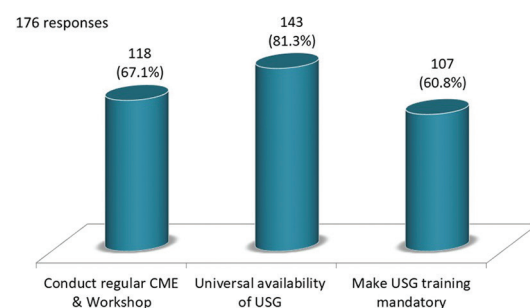


Figure 6: Various suggestions by the member physicians to improve ultrasound education

disadvantage is the variable interpretation of the findings by physicians.<sup>[13]</sup> US-guided sacroiliac joint (SIJ) injection is a good case example when the learning curve with US is concerned. Pekkaflahli *et al.* investigated the feasibility of US-guided SIJ injection in sacroiliitis. They performed a total of 60 SIJ injections. The success rate of intra-articular injection was 60% in the first 30 injections, and it gradually improved to 93.5% in the last 30 injections.<sup>[14]</sup>

**Table 1: Percentage of physicians performing axial blocks (spine and ganglia) either under ultrasound or fluoroscopic guidance or both**

|                                     | US guided (%) | Fluoroscopy guided (%) | Both (%) |
|-------------------------------------|---------------|------------------------|----------|
| <b>Craniofacial</b>                 |               |                        |          |
| Greater occipital nerve block       | 47.7          | 13.1                   | 11.4     |
| Sphenopalatine ganglion block       | 5.2           | 62.5                   | 4.5      |
| Trigeminal nerve block              | 3.4           | 73.9                   | 4.5      |
| <b>Cervical</b>                     |               |                        |          |
| Cervical root block (paraforaminal) | 9.1           | 40.3                   | 5.1      |
| Medial branch block                 | 6.8           | 60.8                   | 13.1     |
| Stellate ganglion block             | 30.1          | 18.8                   | 33       |
| <b>Thoracic</b>                     |               |                        |          |
| Medial branch block/facet joint     | 4.5           | 61.4                   | 11.4     |
| Paravertebral block                 | 42.1          | 25                     | 15.3     |
| Intercostal nerve block             | 46.6          | 16.5                   | 22.7     |
| <b>Lumbosacral</b>                  |               |                        |          |
| Lumbar spinal root block            | 2.3           | 77.3                   | 5.1      |
| Medial branch blocks                | 3.4           | 65.9                   | 17.1     |
| Facet joint injection               | 4.5           | 65.3                   | 17.1     |
| Sacroiliac joint injection          | 13.1          | 46                     | 24.4     |
| Caudal epidural injection           | 12.5          | 37.5                   | 41.5     |
| Celiac plexus                       | 9.7           | 43.8                   | 18.2     |
| Superior hypogastric plexus         | 6.3           | 50                     | 10.2     |
| Ganglion impar                      | 5.7           | 63.1                   | 8        |

The missing data indicate nonresponse in each category. US: Ultrasound

**Table 2: Percentage of physicians performing various nerve blocks and joint injections either under ultrasound or fluoroscopic guidance or both**

| Peripheral nerve blocks and joint injections | US guided (%) | Fluoroscopy guided (%) | Both (%) |
|----------------------------------------------|---------------|------------------------|----------|
| Genicular nerve block                        | 21            | 25                     | 30.7     |
| Suprascapular nerve block                    | 46            | 11.9                   | 26.1     |
| Ilioinguinal nerve block                     | 63.6          | 6.8                    | 8.5      |
| Pudendal nerve block                         | 31.3          | 13.6                   | 6.3      |
| Ankle nerves                                 | 45.5          | 6.3                    | 5.1      |
| Trigger point injection                      | 54.6          | 3.4                    | 8        |
| Knee joint injection                         | 35.2          | 19.3                   | 26.1     |
| Shoulder joint injection                     | 42.6          | 12.5                   | 23.3     |
| Shoulder subacromial bursa injection         | 46            | 11.4                   | 27.8     |
| Acromioclavicular joint injection            | 40.9          | 10.2                   | 17.6     |
| Piriformis injection                         | 28.4          | 22.7                   | 23.3     |
| Lateral femoral cutaneous nerve block        | 62.5          | 4.5                    | 4        |
| Hip joint injection                          | 20.5          | 22.7                   | 17.6     |
| Ankle joints (tibiotalar, subtalar)          | 21            | 17.6                   | 10.8     |
| Greater trochanter injections                | 23.9          | 15.9                   | 13.1     |

The missing data indicate nonresponse in each category. US: Ultrasound

Various image-guided interventions are usually compared based on performance, efficacy, and safety outcomes. Recently, Bhatia and Brull<sup>[3]</sup> performed a meta-analysis of 41 case series and 5 randomized trials to find out if US-guided IPM is beneficial compared to FL. The meta-analysis demonstrated that US is safer for performing injections of the cervical nerve root, cervical sympathetic trunk, suprascapular nerve, and pudendal nerve when compared with traditional techniques. Moreover, the authors observed that US was effective for

performing lumbar nerve root blocks, greater occipital nerve blocks, suprascapular nerve blocks, intercostal nerve blocks, and lateral femoral cutaneous nerve blocks. It is evident that in many peripheral nerve blocks, stellate ganglion block, and joint injections, US has a clear advantage and safer compared to FL. These findings were reflected in our survey, as well.

Surveys are important to get first-hand knowledge of the prevailing practice standards among physicians, their attitudes, barriers, and subsequently, compare the results with other

established standards. This helps in making recommendations and adapting to new changes. Similarly, US surveys have been conducted in the USA, Canada, and South Korea among their pain fellowship programs; however, no such data existed in our country.<sup>[15-17]</sup> Before conducting any survey among the fellowship programs, we decided to conduct a survey among our practicing pain physicians to gather data on US in IPM.

We were able to collect adequate data that provided us with information about the different procedures in chronic pain medicine where US is widely used in current practice [Tables 1 and 2]. Commonly performed interventions under US-guidance include stellate ganglion block, occipital nerve blocks, ilioinguinal blocks, suprascapular nerve block, lateral femoral cutaneous nerve blocks and major joint injections. Similar observations have been found in surveys conducted in North America among pain fellows.<sup>[15,16]</sup>

The pain medicine in India is at crossroads. Until a few years ago, we lacked properly trained pain physicians and a structured pain medicine training course, despite having a huge population and millions of chronic pain patients.<sup>[18]</sup> The academic wing of ISSP, the Indian Academy of Pain Medicine (IAPM), has started a well-designed fellowship program of 12-months in IAPM accredited centers. This is in addition to the fellowships at other universities and the short courses conducted at few pain centers across the country. Furthermore, pain medicine and practice in India has its own challenges, including lack of recognition of pain medicine courses by Medical Council of India, lack of pain education in the undergraduate or postgraduate medical curriculum, strange laws, bureaucratic hurdles, and lack of recognition and insecurity.<sup>[19]</sup>

Our survey is a reflection of most of the points highlighted above. One of the major drawbacks of our survey is the low response rate (15%), despite sending repeated E-mail reminders. Hence, it is difficult to make a generalized conclusion. A higher response rate would be more desirable. Another drawback is that the questionnaire was sent to members who had an active E-mail in the database, thus, missing other members. Nevertheless, it is a good start, and we were able to get decent information on the current state of US use, training, barriers, and future suggestions. Nearly half the respondents work in Academic centers/institution-based pain clinics and have experience of 1–5 years in pain medicine. Except 2.8% of physicians, others use image-guided IPM. More than two-third use both US and FL for MIPS, whereas 20.5% and 7.4% of physicians use FL and US, respectively. This is definitely a good sign as image guidance is a fundamental step for any MIPS. More than three-fourth participants had US available at their workplace, and a similar percentage of physicians expressed that they had training for US-guided pain interventions. Interestingly, workshops are the major source of training (80.1% participants) followed by web-based learning, journals/books, and training during the fellowship. It is not surprising that only 50% of physicians reported having US

training during their fellowships, which reflects that FL was the traditional imaging modality for IPM, and US has come up in recent times only. Another point worth mentioning is that 56% of physicians did not feel that they had adequate US training during fellowships. Unfortunately, we do not have official data on the availability of US in pain fellowship centers across the country at the current time. However, there is a need to make US training mandatory in currently available pain fellowship programs in India.

The survey revealed many challenges and barriers to US in IPM in our country. These include lack of formal teaching/training of US during primary residency programs, nonavailability of the machine, PCPNDT Act prohibiting easy access to the machine, too much emphasis on FL for IPM, and importantly, lack of properly trained pain physicians who can teach US. Bhatnagar *et al.* reported similar challenges when they conducted face-to-face interviews of aspiring pain physicians from different specialties.<sup>[19]</sup> Few problems like lack of adequate pain specialists having a command over US can be a common issue as US in pain medicine is a very recent development and lacked certification until recently where the certification examination was taken by the World Institute of Pain and American Society of Regional Anesthesia and Pain Medicine. Apart from cost and initial learning curve, a major and unique hurdle for Anesthesiologists or Pain Physicians to acquire a US machine is the PCPNDT Act, which came into existence to deal with a “regressive and social issue” of female feticide in India. The provisions in the law have unfortunately affected our specialty in a big way as US has become standard care in regional blocks, central venous cannulations, intensive care unit, emergency medicine, and many other areas that had been ignored our law-makers for many years.<sup>[20]</sup> However, a recent ruling by Delhi High Court in 2016 is a welcome step where doctors and institutes using a US machine could be exempt from complying with the provisions of the PCPNDT Act and other paperwork after providing a declaration stating that “the machine is not intended or not allowed for conducting prenatal diagnostic procedures.” At the same time, there are some encouraging changes in the PCPNDT act on the definition of “sinologist” or “imaging specialist” and other doctors wanting to use US in their practice.<sup>[21]</sup> A combined approach by Indian society of Anaesthesiologists, Academy of Regional Anaesthesia of India and ISSP to the Union Health Ministry to consider easier PCPNDT registration, smooth documentation, and to make special provisions in the law to allow the use of portable US for regional anesthesia, and pain management is the need of the hour.

The way forward to make US in IPM in India is by adequate training, structured US education curriculum, and practical hands-on training at all IAPM accredited fellowship centers as well as non-accredited centers. In the meantime, we can follow the International Collaborative Guidelines (a joint committee of the American, European, and the Asian Australasian Societies of Regional Anesthesia and Pain) where a detailed scope of practice, training

to attain proficiency and skills to perform US-guided IPM, and quality improvement are highlighted in great detail.<sup>[22]</sup> To improve US use in IPM, two pathways of training have been recommended by the joint committee: “practice-based pathway” and “fellowship-based pathway.” The “practice-based pathway” can be helpful for current practicing pain specialists with formal pain training who want additional education to become proficient in US. The modalities for this can be attending accredited CMEs periodically, US scanning on self or on volunteers to get a first-hand-knowledge, practice needle insertion in phantoms, cadavers or simulation and possibly learning further by spending time with an expert. The second pathway is meant for current trainees where compulsory, didactic US education and hands-on training can be imparted in IAPM and other accredited pain fellowship centers in India.

## CONCLUSION

The current survey provided us several insights into the state of US education, training, utility, barriers, and the way forward. The biggest limitation of our survey is limited responses. Finally, multi-organizational approach on dilution of the PCPNDT Act for pain physicians and following the joint international guidelines toward US training will go a long way in improving US education in India.

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## Conflicts of interest

There are no conflicts of interest.

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## APPENDIX

### Appendix 1: Survey questionnaire

1. How long have you been practising Pain Medicine?
  - i. Less than 1 year
  - ii. 1-5 years
  - iii. 5-10 years
  - iv. More than 10 years
2. What kind of Pain clinic do you work?
  - i. Institutional/Academic
  - ii. Corporate hospital
  - iii. Private/Self run Clinic
3. What imaging modality do you use for pain interventions?
  - i. Fluoroscopy
  - ii. Ultrasound
  - iii. Both of above
  - iv. None of the above
4. Is Ultrasound machine available at your workplace for Pain interventions?
  - i. Yes
  - ii. No
5. Do you have any training in doing Ultrasound-guided (US) pain interventions?
  - i. Yes
  - ii. No
6. What is the main method of training for US-guided interventions you have received? (You can choose as many as you feel appropriate)
  - i. Training during fellowship
  - ii. Workshops (Cadaveric/Volunteer hands-on)
  - iii. Internet
  - iv. Text book/Journals
  - v. None of the above
7. Do you feel that you had adequate exposure to US-guided pain interventions during your training/fellowship/observership?
  - i. Yes
  - ii. No
8. What according to you is the biggest obstacle in learning US-guided pain and musculoskeletal interventions? (You can choose as many as you feel appropriate)
  - i. No formal teaching of US and nerve block during residency
  - ii. Non-availability of machine
  - iii. No proper training during pain fellowship or training period
  - iv. Lack of adequate number of properly trained physicians who can teach
  - v. Too much emphasis on fluoroscopy for pain interventions
  - vi. Lack of enough number of cadaveric course to learn in our country
  - vii. PCPNDT act
  - viii. None of the above
9. What can be done by ISSP to improve US use in Pain medicine intervention? (You can choose as many as you feel appropriate)
  - i. Conduct regular CME and Cadaveric workshop on US
  - ii. Make US training mandatory in IAPM accredited centers and other academic and private pain centers in our country
  - iii. Make universal availability of US for Pain use by forcing authorities to dilute the existing PCPNDT act
  - iv. Any other suggestions:
10. Please check if you have experience or doing following pain interventions?

☐ Please check with US and Fluoroscopy only if you have experience

|                                                     | US guided                | Fluoroscopy guided       |
|-----------------------------------------------------|--------------------------|--------------------------|
| Head                                                |                          |                          |
| Greater and lesser occipital nerve block            | <input type="checkbox"/> | <input type="checkbox"/> |
| Sphenopalatine ganglion block                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Trigeminal nerve block                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Cervical                                            |                          |                          |
| Cervical root block (paraforaminal)                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Medial branch block                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Thoracic                                            |                          |                          |
| Medial branch block/facet joint                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Paravertebral block                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Intercostal nerve block                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Lumbar                                              |                          |                          |
| Lumbar spinal root block                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Medial branch blocks                                | <input type="checkbox"/> | <input type="checkbox"/> |
| Facet joint injection                               | <input type="checkbox"/> | <input type="checkbox"/> |
| Caudal epidural injection                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Peripheral nerves, sympathetic and joint injections |                          |                          |
| Stellate ganglion block                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Genicular nerve block                               | <input type="checkbox"/> | <input type="checkbox"/> |
| Suprascapular nerve block                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Iliohipogastric and ilioinguinal nerve block        | <input type="checkbox"/> | <input type="checkbox"/> |
| Pudendal nerve block                                | <input type="checkbox"/> | <input type="checkbox"/> |
| Ankle nerves                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| Trigger point injection                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Sacroiliac joint injection                          | <input type="checkbox"/> | <input type="checkbox"/> |
| Knee joint injection                                | <input type="checkbox"/> | <input type="checkbox"/> |
| Shoulder joint injection                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Shoulder subacromial bursa injection                | <input type="checkbox"/> | <input type="checkbox"/> |
| Acromioclavicular joint injection                   | <input type="checkbox"/> | <input type="checkbox"/> |
| Piriformis injection                                | <input type="checkbox"/> | <input type="checkbox"/> |
| Lateral femoral cutaneous nerve block               | <input type="checkbox"/> | <input type="checkbox"/> |
| Hip joint injection                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Ankle joints (tibiotalar, subtalar)                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Greater trochanter injections                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Celiac plexus                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Superior hypogastric plexus                         | <input type="checkbox"/> | <input type="checkbox"/> |
| Ganglion impar                                      | <input type="checkbox"/> | <input type="checkbox"/> |

US: Ultrasound

Author Queries???

AQ1: Kindly provide department.

AQ2: Please upload copyright form signed by all authors

AQ3: Kindly check the abbreviation “FL” having two expansions “fluoroscopic” “fluoroscopy”. Kindly suggest which one we have to follow

AQ4: Kindly move to the text part.

AQ5: Kindly provide expansion.