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# THE EFFICACY OF HANGING DROP TECHNIQUE IN CERVICAL EPIDURAL

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**ABSTRACT**

**Background**: cervical epidural intervention is a highly sophisticated intervention. Loss of resistance technique is commonly used for this purpose to identify the epidural space besides hanging drop technique. **Aim of study**: To evaluate and asses the efficacy of hanging drop technique, in order to detect the cervical epidural space in cervical epidural intervention. **Patient and method:** A cross sectional study was carried out on 30 patients participated in this study in Medical city \Baghdad teaching hospital Pain management department. Between the period of 1st of June 2019 to 1st of august 2020. HD(hanging drop) technique was used to identify the epidural space confirmed by fluoroscope. **Result**: Successful hanging drop down into the needle was 26 cases out of thirty (86.67%) while in the other 4 cases (13.33%) the drop down of the hanging drop was not observed. **Conclusion:** hanging drop technique is an effective technique to identify the epidural space.

**KEYWORD**: Hanging drop technique, epidural space, pain management, cervical epidural.

## INTRODUCTION

Epidural injection has a wide range of applications in anesthesia, analgesia, acute and chronic pain management. It can give dense block, motor effect or only sensory effect. Cervical epidural is one of its applications in pain management, as single shot or catheter placement.

Epidural space surrounds the Dura mater and the nerve root cross this space laterally to become peripheral nerves.[1]

Forester, Sicard first introduce epidurography in 1926 as diagnostic tool, Anesthesiologist observe the spread of solution, to detect the nerve block.[2]

Epidural analgesia has a superior effect on other modality, relaying on it reliving effect.[3]

Cervical nerve block can be beneficial in two manners as diagnostic and therapeutic, as the nerve is the cause of pain or the consequence.[4]

Current treatment strategy goal to lessen the invasiveness. The cervical epidural space begin at foramen magnum and descends downward to the thoracic epidural at C8-T1 vertebrae.

The superior border is fused with the periosteum and spinal layer of dura at foramen magnum.

Anteriorly there is the posterior longitudinal ligament, the ligamentum flavum lie posteriorly.

Lateral to the cervical epidural space is the pedicle and the intervertebral foramen.

The epidural space contain connective tissue, fat, veins, arteries, and lymphatic plexus.

The cervical epidural space is 2 mm at the level of C5 and 4 mm at the level of T 1, flexion of the neck will wide this space by 4mm, and it is the reason we flex the neck during procedure.[5]

Nerve root increase in size as we go caudally in cervical region. The fat in this region will serve as shock absorber and a depot for the drugs injected.

Epidural artery and veins plexus lies in the anterolateral aspect of the cervical epidural a trauma to these plexus can cause hematoma and compression of blood supply to the spinal cord.

Veins of this region are valve less so any increase in pressure of abdomen or local tumor or Valsalva maneuver could engorge these veins and reduce the epidural space of cervical region.[6]

Epidural injection used for reliving radicular pain most of the cases has nerve root compression and edema.[5]

Clinical improvement goes with relieve of this inflammation and edema; a second injection may be given after 2 weeks.[1] As the epidural space has a negative pressure range from -1 to -10 cm $H_2O$, according to the region increased cephalic and decrease caudally, also affected by positioning increased by sitting position.

Cervical epidural has several indications all of them are radicular pain As example acute disk herniation, cervicalgia, complex regional pain, acute post herpetic neuralgia of the cervical and upper extremities.

Shoulder hand syndrome, post laminectomy syndrome due to discectomy, spondylosis of cervical vertebrae and stenosis of nerve root in the cervical vertebrae.[5]

Several methods and technique were used to identifies the cervical epidural space.

1. Loss of resistance technique with air, saline.
2. Spring loaded.
3. Macintosh balloon.
4. Hanging drop technique.

**Aim of study**

To evaluate and asses the efficacy of hanging drop technique, in order to detect the cervical epidural space in cervical epidural intervention.

**PATIENT AND METHOD**

A cross sectional study was carried out on 30 patients that in Medical city\ Baghdad teaching hospital\Pain management department.

Between the period of 1st of June 2019 to 1st of august 2020. the study proposal was approved by the Iraqi scientific council of anesthetic and intensive care in Iraqi board.

**Inclusion criteria**

- Moderate to severe Cervical pain with or without upper limb radicular pain due to (Disk prolapse, Central or foraminal spinal stenosis, Cervical spondylolisthesis) not responding to medical management.
- Weight 50kg to 110kg.
- Height 150cm to 200cm.

**Exclusion criteria**

- Patient refusal.
- Previous cervical surgery (altered anatomy).
- local infection, febrile.
- Coagulopathy in PT, PTT, INR, platelet count and function abnormality, anticoagulant drugs.
- Allergic or contraindicated to any drugs in the study.
- Uncontrolled hypertension, diabetic, heart failure.
- Obese patient BMI more than 30.

All patients were examined. history was taken about the pain, it's origin, nature, severity, duration, and radiation . The presence of weakness, numbness, also the sign of upper motor neuron lesion.

Past medical history, drugs history, and which drugs were used for treatment of this radicular pain.

After confirmation of medical treatment failure an appointment is declared for patients for their intervention.

Patient is admitted to the intervention room vital signs are measured, cannula is inserted, Prone positions are used for our patients.

The fluoroscopy of choice is the C arm which moves in all planes to confirm the proper position of the Tohey needle. The level is determined usually at C7 T1 level, sterilization is done and local anesthetic agent is injected for the skin. An A_P view taken to confirm good alignment and level. Tohey needle is advanced toward the lamina for 2 cm then stylet is removed. At this stage a lateral view taken to confirm the proper position for the safety.

The difficulty in performance of loss of resistance technique is the use of one hand for the needle advancement and the other hand for the syringe, in contrast to the HD technique both hand were used to control and advance the needle in the cervical region.

A drop of normal saline is applied to the hub of the needle that is advanced toward the epidural space. Slipping from the bone should be considered.

When the tip of the Tohey needle enters the cervical epidural space the drop is withdrawn by the negative pressure of the space. If failure of identification of the space loss of resistance technique were used in case of pass the fluoroscopic land mark without.

Before treatment agents are given a fluoroscopic dye is given via the needle to ensure good distribution and

proper space position, and prevent loculation of contrast at one side.

Then treatment drugs are given according to the case usually local anesthetic agent is lidocaine 0.5% or bupivacaine 0.25% and steroid.

the data were analyzed using statistical package for serial sciences (SPSS) version 24.

Continuous variable were expressed as mean ±SD. For dichotomous data, frequencies and percentages were calculated. Student t-test was used to compare means as required.

A two sided p-value ≤0.05 was considered to be statistically significant.

## RESULTS

Mean age of the patients was 51.81±11.31 years (range 32-70 years). Stratification of age into groups revealed that age group 45-57 years was the most common accounting for 40% followed by age class 58-70 years (30%) and 32-44 years (30%) (table 1-1).

Males represented about two-third of the patients (63.33%). Mean BMI was 29.89±3.81 kg/m2 with the vast majority of the patients were overweighed or obese (Table 1).

**Table 1: Patients' characteristics and demographic data (n=30).**

| Variables | Frequency | Percentage |
|---|---|---|
| **Age, years** | | |
| 32-44 | 9 | 30% |
| 45-57 | 12 | 40% |
| 58-70 | 9 | 30% |
| **Gender** | | |
| Male | 19 | 63.33% |
| Female | 11 | 36.67% |
| **Weight, kg** | | |
| ≤ 85 | 13 | 43.33% |
| >85 | 17 | 56.67% |
| **Height, cm** | | |
| ≤ 165 | 18 | 60% |
| >165 | 12 | 40% |
| **Body mass index, kg/m$^2$** | | |
| **< 25** | 4 | 13.33% |
| **25-29.9** | 14 | 46.67% |
| **≥30** | 12 | 40% |

Successful hanging drop down into the needle was 26 cases out of thirty (86.67%) while in the other 4 cases (13.33%) the drop down of the hanging drop was not observed (Figure 1).

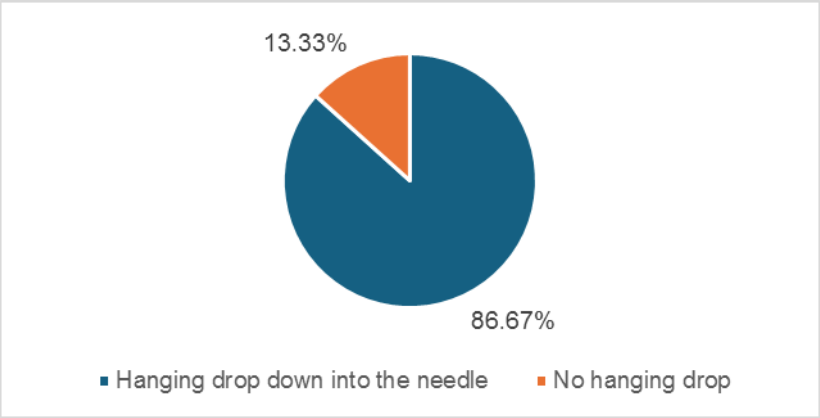


**Figure 1: The proportion of hanging drop down into the needle.**

Fluoroscopy was used to confirm the injection of dye into the cervical epidural.

Patients converted to loss of resistance technique had higher age, weight and BMI (55.33±13.41years, 90.0±13.55 kg and 31.35±3.44 kg/m2, respectively) than those performed with hanging drop technique (50.88±11.11 years, 83.33±12.9 kg and 29.52±3.87 kg/m2, respectively); however, the difference were not significant.

The majority of the sample was between 90 to 110 kg as shown in figure (3-3) Similarly, there was non-significant higher frequency of female patients (66.67%) and neck pain (66.67) among patients converted to loss of resistance technique than those with hang drop technique (29.17% and 55.57% respectively) as shown in table(2).

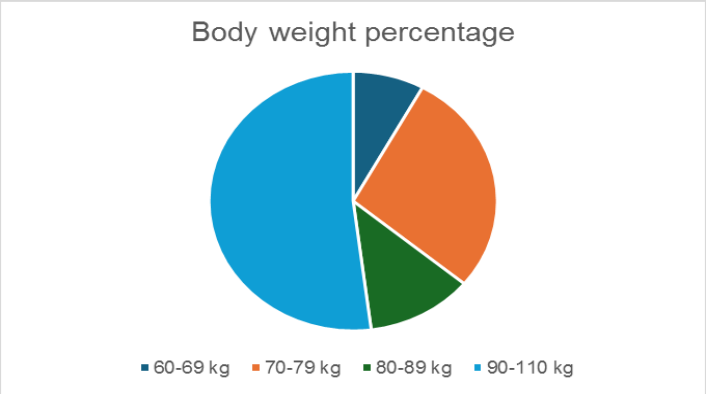


**Figure 2: Body weight in kg for the sample.**

**Table 2: Association of the conversion with demographic and clinical Characteristics.**

| Variables | No conversion N=24 | Conversion N=6 | p-value |
|---|---|---|---|
| **Age, years** | 50.88±11.11 | 55.33±13.41 | 0.405 |
| **Gender**<br>Male<br>Female | <br>17(70.83%)<br>7(29.17%) | <br>2(33.33%)<br>4(66.67%) | 0.088 |
| **Weight** | 83.33±12.9 | 90.0±13.55 | 0.272 |
| **Height** | 167.92±8.76 | 169.5±15.21 | 0.737 |
| **BMI, kg/m$^2$** | 29.52±3.87 | 31.35±3.44 | 0.301 |

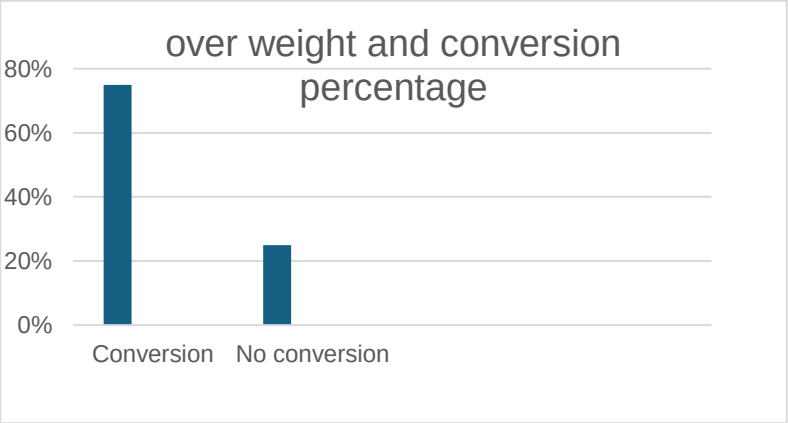


**Figure (3): over weight group percentage of conversion to LOR.**

In all included cases, none had CSF leakage (0%) or perioperative complications (0%).

## DISCUSSION

The present study aimed to evaluate the efficacy of hanging drop technique in cervical epidural anesthesia with the aid of fluoroscopy.

Failure of epidural anesthesia or analgesia can occur due to many reasons, the most important is inability to guide the needle through interspinous or interlaminar gap into the epidural space.[7]

Many methods have been developed to identify this space.

Of these, the LOR technique is preferred, whereas the HD technique may be of value in placing thoracic epidural because of intrinsic negative pressure within the region of thoracic epidural space.[8]

According to the result of the present study, successful hanging drops down was observed in 86.67% of cases. This percentage parallels that of many previous international studies.

When performing lumbar and low thoracic epidural injection below the T8 level, a positive hanging drop technique sign in 80% of cases.[9]

In a study of 1002 single shot lumbar epidural neuro axial blocks by Sheehan et al., a positive sign occurred in majority 91% of cases.[10]

Thus HD has a very good efficiency the identification of epidural space and its comparable with that of LOR technique.

Unfortunately, there is no available studies about using HD technique in cervical epidural.

However, some studies did not recommend using this hanging drop technique to identify the lumbar epidural space because of the absence of a true negative pressure in the region.[11]

In contrast, region of cervical epidural space has prominent negative pressure with encourage the use of HD technique.[12]

In the current study, HD technique was successfully completed in 26 out of 30 patients (86%). However, in 6 patients (13%) the procedure was converted to loss of resistance technique.

In a similar study of Hoffmann et al. [1999][8] compared skin to epidural space distance in both techniques. This indicated that the hanging drop technique may be equally effective in identifying the lumber epidural space as LOR technique.

Demırel et al. [2017][13] compared HD with LOR and automatic LOR syringe for identifying epidural space. The authors did not found significant difference between the three groups in terms of skin epidural distance value which indicate the successful using of HD technique.

In the present study, there was no significant effect of age, gender, weight, height or BMI on the successful identification of epidural space by HD. In some studies, it was found that with increase in BMI the distance from skin to the epidural space also increases. The distance from the skin to the epidural space does not depend on the age or the sex of the patients. The non-significant result of BMI in the present study may be due to relatively small sample size.[14]

In all included cases, there was no complication after HD technique in the present study. In accordance with this result is Gosai et al. [2015][15] who compared the efficiency of HD technique with LOR in 60 Indian patients posted for gynecological surgery.

No evidence of any type of neurological complication was observed in any case during the entire study. In every case the epidural catheter was removed intact which was confirmed by the bulb tip at the end of the catheter. The authors concluded that there was no difference between the HD and LOR techniques in either identifying the lumber epidural space and complication rate. However, in a Turkish study, Demırel et al. [2017][13], recruited 60 patients undergo lumbar epidural anesthesia or analgesia to compare between LOR, automatic LOR and HD in identifying the epidural space.

While none of LOR, automatic LOR had any complication, 10 % of the patients in HD group suffered from dural damage with Tuohy needle; although the differences between groups was no a significant. Hoffmann, et al. [1999][8] indicated that lumbar epidural space could be applied successfully by both HD and LOR; however, when compared with hanging drop, dural damage was less than that of resistance loss technique.[15]

Accidental dural perforation and total spinal blockade are complications which occur when required conditions are not complied with. There is a relationship between the experience of the anesthesiologist and dura perforation. The more the experience, the less dural perforation incidence occurs.[16]

It is an incidence that can occur during locating the needle in epidural space. The reason is that epidural space access is directly depended on defining subarachnoid pressure in spinal canal. While the sub atmospheric pressure is more distinct in cervical and thoracic region; it is not safer in lumbar region.[13]

Hoffmann et al. [1999][8] recorded skin-epidural distance values on 40 patients by using resistance loss and hanging drop technique in their study. They found skin-epidural distance value approximately 5.4 cm by resistance loss technique and approximately 5.4 cm by using hanging drop technique. Some studies indicated that dural puncture risk triples in people whose skin-epidural distance value are lower than 4 cm.[17] This may reflect the absence of complications in the present study.

## CONCLUSION

As the cervical epidural space has a more prominent sub-atmospheric pressure, than thoracic and lumbar epidural space.

Hanging drop is an effective technique to perform cervical epidural intervention for pain control.

And with less incidence of Dural perforation, confirmed by fluoroscope.

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