

## Technique of The Pulse Radiofrequency Procedure for Cervical Spine

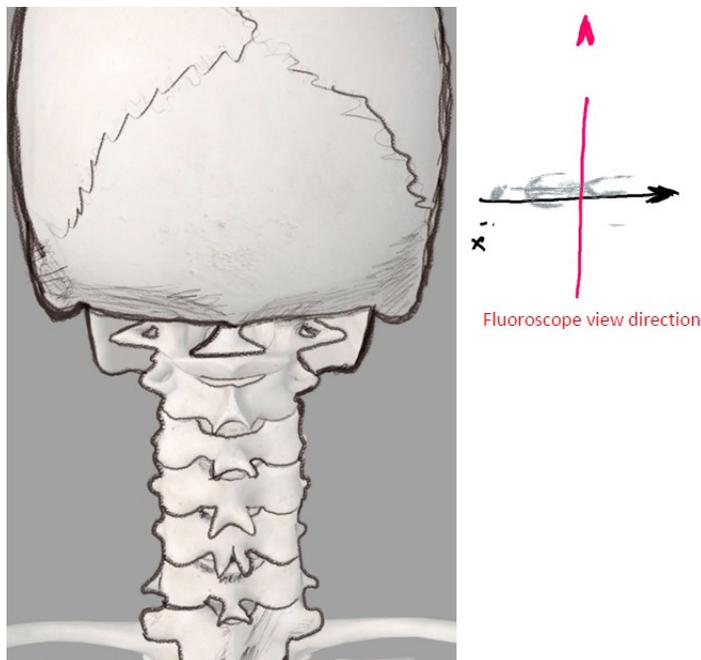
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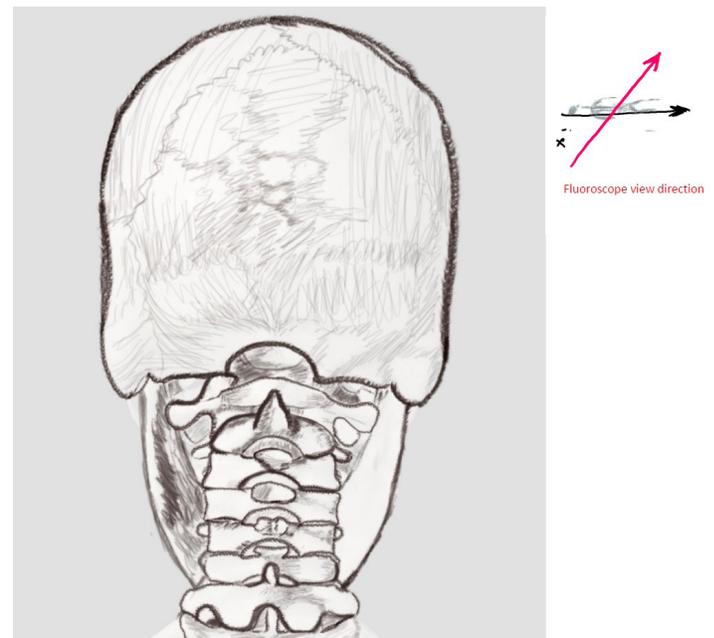
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Following getting appropriate consent, patient would be properly placed in a prone position. NIBP, Oxygen saturation and EKG would be monitored during the procedure. Having C-arm perpendicular to the procedure table, we obtain an anterior-posterior view of the cervical spine (Figure 1). To get a tunnel view of the target, the C-arm angle changes to the cephalo-caudal view (Figure 2). Moreover, we routinely use a spine stabilizing device (Oakworks) that would hold the angle of the cervical spine at about 10 degrees forward flexion, with the most movement at C7 -T1.

**Figure 1:** Anteroposterior view of fluoroscopy.

The skin would be prepared by chlorhexidine and alcohol, and patient will be draped accordingly. The lateral border of the cervical spine would be marked in anteroposterior, cephalo-caudal view of the fluoroscopy. During skin marking, practitioners should

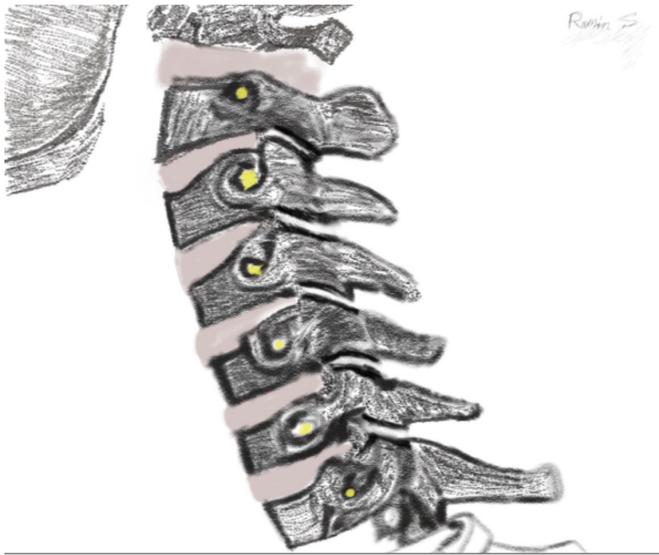
be particularly cautious about the rotation of each level and mark the skin for different levels at the anteroposterior view of that level, according to the position of the neck. Local anesthetic, lidocaine 2%, would be used to anesthetize the skin at the level of C3 and C4 ipsilaterally.

**Figure 2:** Cephalo-caudal view of fluoroscopy.

The author uses a 20-gauge, 10 mm active tip, sharp curved radiofrequency cannula. Following several different approaches in the past, the author suggests starting with the most caudal injection site, C4. By using this approach, the first cannula would not obscure the target of the second cannula. The first cannula would be advanced in anterior and cephalad direction until it reaches the posterolateral aspect of C3 vertebral body. The second cannula would be inserted caudally to the first cannula and would

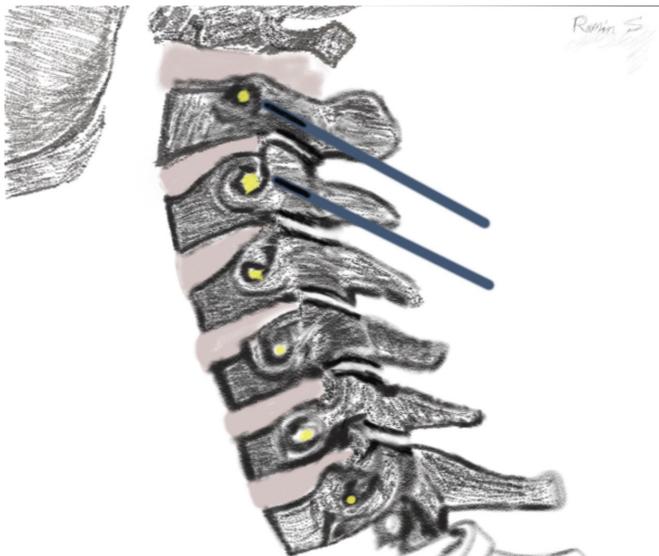
be advanced parallel to the first cannula, to touch the posterolateral aspect of the C2 vertebral body. Local anesthetic, 1-2 ml of lidocaine 2%, would be injected to reduce the discomfort.

The C-arm position would be changed to a lateral view (Figure 3). One must be cautious about making sure that the C-arm locates appropriately to show an accurate lateral aspect of the cervical spine, before advancing the cannula.



**Figure 3:** Lateral view.

At this point, the practitioner would move the tip of the cannula laterally until it walks off the posterior aspect of the bone (Figure 5). The cannula would be advanced while keeping the tip of the cannula in contact with the bone. The goal is to locate the whole length of the cannula's active tip at the lateral aspect of the cervical vertebrae at C2 and C3. One must make sure that the tip of the cannula stops before the line, posterior to neuroforamina, in the lateral view of the fluoroscopy (Figure 4).



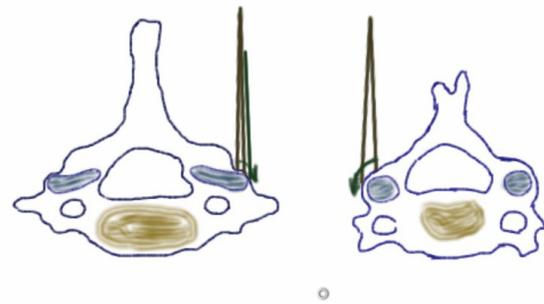
**Figure 4:** Lateral view with RF cannulae placement for C2-3 bipolar PRF.

The RF radiofrequency probe would be inserted into the radiofrequency cannula. Bipolar pulse radiofrequency treatment (Diros Technology) would be applied for 3 minutes with the following setting:

- Maximum allowable temperature 50
- voltage: 90V
- Pulse rate: 3 Hz
- pulse duration: 30 ms

For the C4, C5 and C6 levels, the author suggests using the pulse radiofrequency. The author uses a 20-gauge, 10 mm active tip, sharp curved radiofrequency cannula. One of the main advantages of this technique over the standard procedure would be using the same skin insertion points for the other levels. Monopolar pulse, we do not need to be parallel to the direction of the sensory nerve to see the best results; therefore, we withdraw cannulae to the level of the skin and redirect it toward a new target. At each level, the cannulae would be advanced in anterior direction until it reaches the posterolateral aspect of C4, C5 or C6 vertebral body (Figure 5). Then in the lateral view of fluoroscopy, the practitioner would move the tip of cannula laterally until it walks off the posterior aspect of the bone (Figure 5). The cannula would be advanced anteriorly for another 2 mm while keeping the tip of the cannula in contact with the bone.

## *Ramin's approach*



**Figure 5:** RF cannulae approach placement in cervical spine.

The author suggests using monopolar pulse radiofrequency (PRF) for levels below C3. The fact about the effects of PRF was theoretical, mostly until a well-design study confirmed the effect. Even now, many doctors believe the results of PRF achieved by increasing the temperature in the tissues (lower temperature compare with continuous radiofrequency (CRF), less effectiveness). However, we started learning new facts about PRF.

Based on the study by Carl Kumaradas 1 at al. [1]:

- The energy would be centred at the area of the cannula that geometry suddenly changes, where the sleeve and active tip connect, and where the bevel of the cannula starts shaping.
- The temperature that machine (Diros Technology) calculates is very accurate and within 0.2 C of the computer simulator.
- The voltage of the machine plays an important role in efficacy. On earthworm, until the voltage reached to 70 Volts, the blockage of neuro-conduction was patchy at most.

- Based on the definition of thermal tissue damage, the study proved that the effect of PRF was not thermal.
- Therefore, there is no rationale for advancing the cannula any further. This fact would add to the safety of the procedure.

After confirming that the tip of the radiofrequency cannula is away from neuroforamina and is within the safe zone, the fluoroscopy view would be changed back to anteroposterior, cephalo-caudal view and the location of the cannula tip would be confirmed. Radiofrequency probe would be inserted into the cannula, and a monopolar PRF procedure will be applied for 2 minutes with the following settings:

- Maximum allowable temperature 50
- voltage: 90V
- Pulse rate: 3 Hz
- pulse duration: 30 ms

### Retrospective evaluation at Allevio Pain Management

A 5-year retrospective audit carried out at Allevio Pain Management. Long-term pain improvement interval in PRF, was shown to be longer than CRF in the treatment of cervical facet mediated pain (Tables 1 and 2). As it is shown in the results of our audit, PRF was twice more effective in 7-12 months. Although It has not been expected to have neuritis after PRF, about 11% of patients had shown neuritis until four weeks after the treatment. As well the rate of neuritis (as a side effect of RF in the cervical spine) was significantly less in the PRF group. At four months, still, 5% of people who had CRF suffered from neuritis, whereas after two months, no one in PRF reported this complication. In general, more than 84% of people who had PRF did not experience neuritis (versus 42% in CRF).

	CRF	PRF
No Improvement in Pain Control	13.07%	6.15%
1-6 Month Pain Relief	51.13%	47.70%
7-12 Month Pain Relief	17.61%	32.38%
More than one-year Pain Relief	6.82%	4.62%

**Table 1:** Pain Relief Interval.

	CRF	PRF
No Neuritis	42.29%	84.30%
1-4 weeks	27.42%	11.10%
5-8 weeks	17.14%	4.60%
2-3 months	3.43%	0.00%
3- 4 months	5.14%	0.00%
More than4- 5 months	1.14%	0.00%
6-12 months	1.70%	0.00%
More than one year	1.74%	0.00%

**Table 2:** Neuritis after RF.

Knowing what we know from 5 years audit of all the patients in Allevio Pain Management, we designed a prospective study to compare standard CRF with the new PRF technique for long term management of cervical facetogenic pain. Our hypothesis for the prospective study is based on our observation that showed PRF is as effective as CRF and the risk of neuropathic pain is significantly less in PRF.

### Reference

1. Carl Kumaradas J. PhD, Associate Professor, Department of Physics, Ryerson University.