CELIAC PLEXUS NEUROLYSIS WITH REPEATED AMMONIUM SULPHATE INJECTION FOR THE TREATMENT OF CHRONIC NON-CANCER ABDOMINAL PAIN UNDER CT SCAN GUIDANCE

By
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Introduction

- **Celiac Plexus** is a complex network of nerves (a plexus) located in the abdomen, where the celiac trunk, superior mesenteric artery, and renal arteries branch from the abdominal aorta, at the level of the T12–L1 vertebrae.
introduction

• The plexus is formed (in part) by the greater and lesser splanchnic nerves of both sides, and fibers from the anterior and posterior vagal trunks.
introduction

- celiac plexus is the largest neural plexus innervating the abdominal viscera
- It serves as a relay center for nociceptive impulses that originate from the upper abdominal viscera, from the stomach to the proximal transverse colon (liver, gall bladder, spleen, stomach, pancreas, kidneys, small bowel, and 2/3 of the large bowel)
introduction

• Because the autonomic nervous system is largely responsible for visceral nociception

• Blockade of the celiac plexus reduces visceral pain from upper abdominal organs.
• Celiac plexus blocks are associated with improved pain control and a reduced reliance on pain medication when compared with standard treatments (Yan, et al., 2007)
Neurolysis

• The traditional neurolytic substances, such as phenol and absolute alcohol have been employed successfully to provide long term palliation of up to six months duration for malignancies of the pancreas
• They are very destructive to the surrounding tissues
Neurolysis

- Phenol:
  causes nerve destruction by inducing protein precipitation, separation of the myelin sheath from the axon, and axonal edema.

- Alcohol:
  Ethyl alcohol has similar destructive effect as phenol and is more efficient in destroying nerve cell bodies.
Neurolysis

• Nerve regeneration can occur as long as the nerve cell body is intact, at a rate of 1 to 3 mm per day.
• sensory recovery after phenol is faster than after alcohol
Ammonium Sulfate

• There is minimal literature regarding the use of ammonium sulphate as a neurolytic agent, and much of it is over forty years old.

• Nevertheless, it's effectiveness and possible mechanism of action as a neurolytic agent has been described since the 1930s in sporadic reports in the literature, which have documented prolonged pain relief without permanent neurologic squeals.
The effect of ammonium sulfate injection on peripheral nerve.

Kobayashi J, Mackinnon SE, Langer JC, Hertl MC, Hunter DA, Tarasidis G.

Department of Surgery, Washington University School of Medicine, St. Louis, Missouri, USA.

Abstract
Local anesthetic drugs with prolonged nerve-block effect would have clinical application for postoperative or neuromatous pain relief. This study evaluated the possibility of peripheral nerve neurotoxicity by injection of 10 percent ammonium sulfate. Both intrafascicular and extrafascicular injection of 10 percent ammonium sulfate were tested in the rat sciatic nerve model. One percent lidocaine HCl, 5 percent phenol, and normal saline were similarly injected for comparison. Using histologic studies and motor function evaluation with walking-track analysis, 10 percent ammonium sulfate was found to be neurotoxic when it is injected intrafascicularly; however, extrafascicular injection of this drug did not cause significant nerve injury. The neurotoxicity of the 10 percent ammonium sulfate solution was intermediate between the neurotoxicity of 0.1 percent lidocaine hydrochloride and the marked neurotoxicity of 5 percent phenol solution.

PMID: 9273900 [PubMed - indexed for MEDLINE]
The effect of ammonium sulfate injection on peripheral nerve.

Kobayashi J, Mackinnon SE, Langer JC, Hertl MC, Hunter DA, Tarasidis G.

Source
Department of Surgery, Washington University School of Medicine, St. Louis, Missouri, USA.

One percent lidocaine HCl, 5 percent phenol, 10% ammonium sulfate and normal saline were similarly injected for comparison

**Conclusion**: The neurotoxicity of the 10 percent ammonium sulfate solution was intermediate between the neurotoxicity of 0.1 percent lidocaine hydrochloride and the marked neurotoxicity of 5 percent phenol solution.
Intrathecal injection of ammonium sulfate and bupivacaine in peripheral nerves of neonatal and juvenile rats.

Hertl MC, Hagberg PK, Hunter DA, Mackinnon SE, Langer JC.

Abstract

BACKGROUND AND OBJECTIVES: Regional nerve blocks are often used for the treatment of postoperative pain in children. Ammonium sulfate is a non-narcotic anesthetic agent, which has been reported to provide pain relief lasting days to weeks, with few reported side effects in adult studies. Prior to considering clinical use in children, the neurotoxicity of ammonium sulfate in 4-day and 3-week old rats was assessed and compared with that of bupivacaine.

METHODS: Each rat received a posterior tibial nerve intrathecal injection (0.01 mL in 4-day-old and 0.02 mL in 3-week-old rats) using either 10% ammonium sulfate (n = 24 per age group), 0.5% bupivacaine (n = 18 per age group), 0.9% saline (n = 18 per age group), or 5% phenol (n = 18 per age group). A functional assessment by serial walking track analysis and a morphologic assessment by neurohistology were made.

RESULTS: No abnormalities in serial walking track analysis and no structural nerve damage were detected after ammonium sulfate, bupivacaine, or saline injection. Bupivacaine caused mild focal changes in both age groups, which recovered by 8 weeks.

CONCLUSIONS: Intrathecal injection of ammonium sulfate was as safe as bupivacaine in this animal model. Further animal studies must be made before human trials are initiated.

PMID: 9570603 [PubMed - indexed for MEDLINE]
Intrafascicular injection of ammonium sulfate and bupivacaine in peripheral nerves of neonatal and juvenile rats.

Hertl MC, Hagberg PK, Hunter DA, Mackinnon SE, Langer JC.

Source
Department of Surgery, Washington University School of Medicine, St. Louis, Missouri, USA. Regional Anesthesia and Pain Medicine 23(2): 152-158, 1998

- **Histology** Neither saline or ammonium sulfate injection caused any structural abnormality in neonatal or juvenile rats. Bupivacaine caused mild focal changes in both age groups, which recovered by 8 weeks.

- **conclusion**: Intrafascicular injection of ammonium sulfate was as safe as bupivacaine in this animal model. Further animal studies must be made before human trials are initiated.
In 1942, Bates and Judovich (*) reported over 3,000 clinical cases in which paravertebral or local infiltration of a 6% ammonium sulfate solution was used for the treatment of neuralgia. Their patients experienced a transient increase in pain intensity in the affected distribution for approximately 30 minutes followed by pain relief without local tissue damage, motor weakness, or reduction in touch, pinprick, pressure, or temperature sensation.
In a large series, Dam (*) reported experience with 20% ammonium sulfate injection for complex regional pain syndromes I and II, intercostal block for rib fractures or bronchopneumonia, coccygodynia, cicatricial pain (scar neuroma), fibrositis and myositis, trigeminal neuralgia, ilioinguinal and iliohypogastric neuralgia, and postherpetic neuralgia. Between 56% and 84% of patients were pain free, 10% to 20% experienced temporary relief, and approximately 20% were unaffected.

Summarized literature review concerning Ammonium Sulphate as a Neurolytic agent

• Miller et al. (*) reported 41 adult patients who had intercostal block with 10% ammonium sulfate solution after thoracotomy, of whom 60% experienced excellent pain relief lasting up to 21 days.

Ammonium Sulfate

At our institution,

• ammonium sulphate has been used as a neurolytic agent for the celiac plexus for over twenty-five years, and has the significant advantage of having no appreciable effect upon the surrounding tissues.

• As such, it has been successfully employed in the long term in repeated administrations for patients suffering from chronic, intractable non-cancer upper abdominal pain.
The purpose of this study:

1. To describe our experience using ammonium sulphate as a neurolytic agent producing adequate neurolysis of the celiac plexus for analgesia.
2. To report in the side effects associated with these treatments.
3. To compare this modality and our particular technique with the established use of conventional neurolytic agents.
4. To evaluate our practice in this particular procedure analyzing data from our 25 year experience.
5. To be as a base to do further researches in this field
What should we get from this:

1) provide information on the use and practice of the celiac block with Ammonium Sulfate.

2) detect signals about the benefits and risks of the use of this block in the general population.

3) help formulate hypotheses to be tested in subsequent experiments.

4) to report our personal experience and provide suggestions for technique optimization.
Methods

- the charts of all patients currently receiving neurolytic celiac plexus blocks with ammonium sulfate at our institution, or being evaluated to receive them will be identified and will be reviewed.

- At present, there are 42 such patients, all are adults with chronic non-malignant abdominal pain
Methods

• These patients will be asked to complete questionnaires and chart reviews will be undertaken. Pain scores prior to and following initiation of therapy will be evaluated as will duration of effect.

• Any incidences of side effects or complications will be recorded.
Methods

- technical considerations pertaining to the technique used in our institution will be compared to those reported in the literature. Statistical analysis will be undertaken where applicable.
- Inclusion and exclusion criteria's
- Investigations prior to the procedure
- Consent form
- Procedure description
Patient name:                                     Age:
Gender:                                         
Diagnosis:

How long have you been receiving Celiac Plexus Blocks? _____ Months or _____ Years
   How often? Every ______ months.
How do you best describe your Pain?
   Dull ache
   Shooting
   Burning
   Sharp
   Throbbing
   Other___________________________________________
Questioner

- Out of a scale of 10, what is your average pain before your celiac plexus blocks? ____

- Out of a scale of 10, what is your average pain after a celiac plexus block? ____

- How long is celiac plexus block effective for on average? ______ Months ______ Weeks

- How long does it normally take for the block to take effect? ______ Hours ______ Days

- How long does it normally take you to recover/return to normal function after a block? _______ Hours _______ Days
Questioner

Please describe any side effects from the blocks
   Yes or No | What percentage of time | For how long usually |
Abdominal cramping_____________________________________________________________
Diarrhea______________________________________________________________
Nausea______________________________________________________________
Vomiting______________________________________________________________
Back pain______________________________________________________________
Failure to ejaculate______________________________________________________
Other ________________________________________________________________

9. Have you experienced any complications from celiac plexus blocks. Please describe.
   ..............................................................................................

10. Have you done any of these investigations before the procedure 1-
    CT Scan           2- MRI.       3- Abdominal X ray
    ..............................................................................................
11. How long did it take to put you in schedule for the procedure?

12. Is the timing between the procedures enough to cover your pain flare ups?  
   Yes  No  
   If not, what would be the adequate timing for your pain?

13. How many hours or days are required after the procedure to achieve adequate pain control?

What is your score of Pain out of 10 (0= No Pain- 10= the MAX Pain) before the procedure?
   0 (_____::____::____::____::____::____::____) 10

15. What is your score of Pain after the procedure?
   0 (_____::____::____::____::____::____::____) 1
16. PRESENT MEDICATIONS:
List all prescribed and over-the-counter medications (Tylenol, aspirin, etc.) nutritional supplements, herbal

Please include medications for pain, sleep, chronic conditions, etc.
Medication Dosage / day Side effects (if any) How effective

.......................................................... ..........................................................
.......................................................... ..........................................................
..........................................................

17. How much do you think this block reduce your intake of the pain medications or pain relieving substances?

None       Some       All the time

0% (_____ : _____ : _____ : _____ : _____ : _____ ) 100%

18. Have you had any other kinds of treatments (like acupuncture, physiotherapy TENS ... etc). And for how long?

.......................................................................................
19. List any surgical procedures that you have had to relieve pain. Use separate sheet if needed.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Where</th>
<th>When</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

20. How much does pain interfere with your social life (dancing, games, going out, eating with friends, etc.)? before and after the block

None | Some | No activities

0% (____:____:____:____:____:____:____:____:____) 100%

21. How much does pain interfere with your job? before and after

None | Some | I can’t work 0%

(____:____:____:____:____:____:____:____:____) 100%

(DALLAS PAIN QUESTIONNAIRE)

22. Do you find that this procedure has an impact on your quality of life

Yes | No

Describe Please
THANK YOU