SCIENTIFIC RESEARCH

EVALUATE THE EFFECTS OF CT-GUIDED SPLANCHNIC NERVE NEUROLYSIS IN PAIN CAUSED BY UPPER ABDOMINAL VISCERAL MALIGNANCIES

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SUMMARY

Objective: This study aims to assess the efficacy of CT-guided splanchnic nerve neurolysis in alleviating pain associated with malignancies in the upper abdominal viscera.

Methods: A single-arm investigation involved 20 patients diagnosed with upper abdominal visceral malignancies and experiencing pain with a VAS ≥ 7. All participants underwent CT-guided splanchnic nerve neurolysis utilizing absolute alcohol ablation. Pain intensity was measured using the visual analog scale (VAS) one-day post-procedure, at one week, and at one-month follow-up. The primary endpoint was to evaluate the effectiveness of pain relief based on VAS scores. Incidences of intra- and post-procedural complications were meticulously documented.

Results: The mean age of participants was 60.7±11.1, with 12 men and 8 women included in the study. Assessment of pain relief, as per the Visual Analogue Scale (VAS) one day following the intervention, revealed a 70% efficacy in the group with substantial relief and 30% with moderate relief. The average VAS score exhibited a significant decrease immediately post-intervention (8.7±1.1 vs. 3.4±1.3, $p<0.05$). The average VAS scores remained relatively stable at 2.6±1.5 and 2.1±1.5 at the one-week and one-month follow-up, respectively. Common complications included orthostatic hypotension (40%), initial pain (30%), acute intoxication (25%), and diarrhea (15%). No instances of severe complications were recorded.

Conclusion: CT-guided splanchnic nerve neurolysis using absolute alcohol is deemed a secure and productive method for promptly mitigating pain and sustaining pain stability for up to one month.

Keywords: *splanchnic nerve neurolysis, upper abdominal organs, cancers, VAS.*

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I. INTRODUCTION

Cancer represents a prevalent global affliction, and Vietnam is no exception to its widespread impact. As per the Globocan 2020 data, Vietnam reported 182,563 incident cases of cancer, resulting in 122,690 fatalities [1]. Despite notable strides in diagnostic and therapeutic modalities, the terminal phases of cancer often entail pronounced disease progression and heightened mortality rates. Palliative care assumes paramount significance, particularly in the realm of pain management, as it plays a pivotal role in enhancing the quality of life for afflicted individuals. In instances of severe pain, the recourse to morphine is a common practice; however, it is inherent addictive nature and diverse adverse effects on the nervous system underscore the necessity for a comprehensive approach to pain relief. Consequently, the confluence of multiple pain management strategies becomes imperative to achieve optimal pain reduction while mitigating undesired side effects.

The utilization of CT-guided splanchnic nerve neurolysis emerges as a prevalent method for pain control stemming from primary or metastatic cancers affecting upper abdominal organs. This technique operates by disrupting the pain transmission pathway originating from the afflicted organ and extending to the spinal cord via the sympathetic nervous system. The intervention involves the injection of absolute alcohol, primarily targeted at the retrocrural space. Notably, the procedural guidance is facilitated by diagnostic imaging tools, with computed tomography (CT) scans standing out as particularly efficacious in surmounting the limitations associated with alternative methodologies [2]. This gentle yet highly effective intervention method finds substantiation in a plethora of international studies [3]. Nevertheless, its application within the healthcare landscape of Vietnam remains confined to select medical institutions, warranting a more comprehensive evaluation of its efficacy and safety in this specific context. Consequently, our research initiative is dedicated to scrutinizing the outcomes of pain reduction in abdominal organ cancers through the application of CT-guided splanchnic nerve neurolysis.

II. METHODS

Research Subjects

The cohort for this study comprises 20 patients grappling with persistent pain arising from upper abdominal organ cancers, with a duration exceeding 3 weeks and a VAS score ≥ 7. These patients underwent splanchnic nerve neurolysis under CT guidance.

Research Methods

Procedure Overview: The research intervention involved the administration of CT-guided splanchnic nerve neurolysis using absolute alcohol ablation, targeting the retrocrural space. The intervention spanned from March 2021 to the conclusion of June 2023 and was conducted at the Vietnam National Cancer Hospital. VAS assessments were executed both pre and post-intervention at specific intervals: 1 day, 1 week, and 1 month after the alcohol injection. Any observed complications were meticulously recorded. The outcomes were stratified based on VAS reduction, categorized as good (>4 points), moderate (2-4 points), and ineffective (0-1 point).

Study Design: This study adopts an interventional approach devoid of a control group, encompassing both prospective and retrospective elements. A longitudinal follow-up methodology is employed, and the study relies on a convenient sample size. Data acquisition, storage, processing, and analysis will be executed utilizing the SPSS 20.0 software.

Procedural Details: Patients assumed a prone position on the examination table, and marked location imaging facilitated precise needle insertion at the transverse level of D12. Two Chiba needles (25G) were then introduced under CT guidance, with their tips positioned in the retrocrural space, behind the diaphragmatic crus. Verification of needle tip placement involved the administration of 3 ml of diluted contrast medium at a 1/10 ratio. Bilateral block tests ensued, employing 10ml of 1% Lidocaine. A positive block test, indicated by pain relief, guided the subsequent step. The injection of absolute alcohol, a gradual process lasting five minutes, involved the administration of 5-20ml on each side. This ensured comprehensive coverage of the upper abdominal region from the level of D10 to D12, with meticulous care taken to prevent spillage into the retroperitoneal space.

III. RESULTS

The research was undertaken with a cohort of 20 patients afflicted by upper abdominal organ cancers who underwent CT-guided splanchnic nerve neurolysis using absolute alcohol ablation. The study transpired at the Vietnam National Cancer Hospital and spanned from March 2021 to the conclusion of June 2023.

Table 1. General information

General Information		Number	Percentage
Gender	Male	12	60%
	Female	8	40%
Average Age		60,7 ± 11,1	

Comments: The male-to-female ratio within the group was 1.5. The average age of the participants was 60.7±11.1 years, displaying a range spanning from 39 to 82 years.

Table 2. Pain level before intervention

VAS	Mild Pain, Discomfort (4-5)	Severe Pain (6-7)	Persistent Severe Pain (8-9)	Unbearable Pain (10)	Total
N	0	3	11	6	20
Percentage %		15%	55%	30%	100%

Comments: A predominant prevalence of severe pain was evident among the participants in the study. Specifically, 11 patients (55%) reported enduring persistent severe pain, while an additional 6 patients (30%) described their pain as unbearable.

Table 3. Pain reduction efficacy according to vas immediately after intervention (1 day)

Pain Reduction Efficacy	Number of Patients	Percentage (%)
Good (VAS reduction > 4)	14	70%
Moderate (VAS reduction 2 - 4)	6	30%
No Effect (VAS reduction 0 - 1)	0	0%
Total	20	100

Comments: The majority of patients experienced a favorable outcome in terms of pain reduction immediately following the intervention, constituting 70% of the cohort. Notably, none of the patients exhibited any discernible effect in pain reduction.

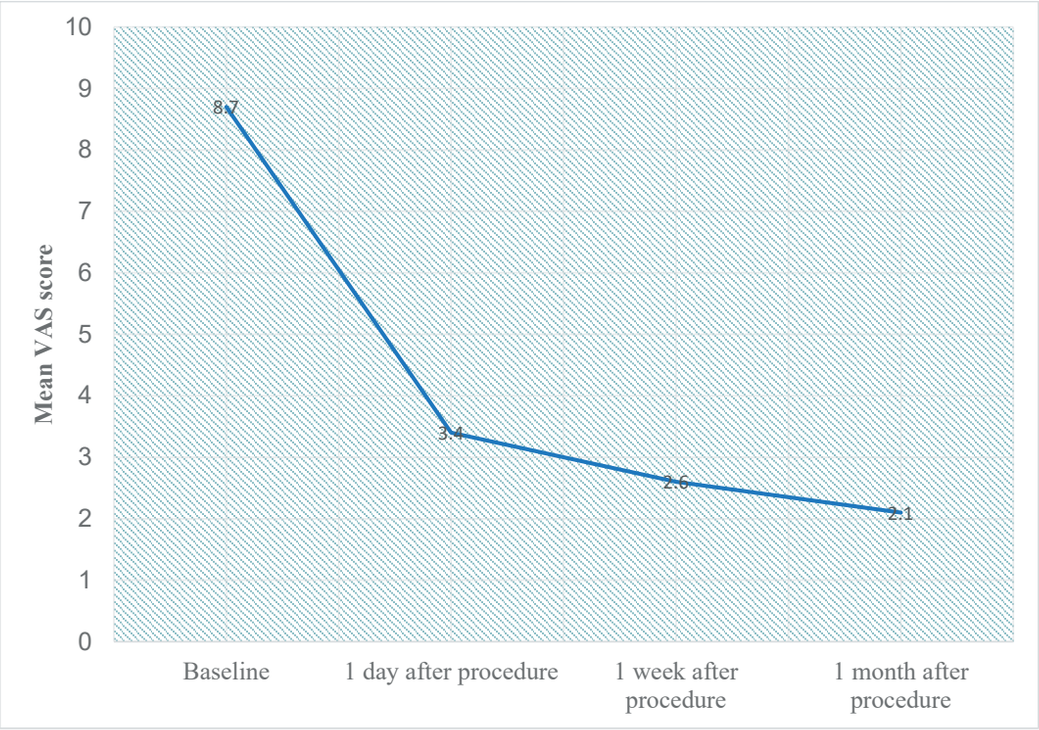

Chart 1. Average pain level (on vas) before and after intervention at different time points

Comments: The mean pain level, as measured on the VAS scale, before the intervention, stood at 8.7±1.1. Subsequently, one - month post-intervention, a substantial reduction was observed, with the average pain level decreasing to 2.1±1.5.

Table 4. Pain reduction efficacy for each disease group

Disease Group	Number of Patients	Percentage	Pain Reduction Efficacy (%)		
			Good	Moderate	Poor
Pancreatic Cancer	13	65%	69.2%	30.8%	0%
Esophageal Cancer	4	20%	75%	25%	0%
Liver Cancer	1	5%	0%	100%	0%
Lymph Node Metastasis	2	10%	100%	0%	0%

Comments: Notably, all disease groups, except the liver cancer group, predominantly exhibited good pain reduction efficacy. The liver cancer group, while achieving a pain reduction efficacy rated as moderate, recorded a 100% success rate in this regard.

Table 5. Unexpected effects, and complications

Complication	Number	Percentage %
Orthostatic hypotension	8	40%
Alcohol Intoxication	5	25%
Diarrhea	3	15%
Initial Pain	6	30%
Nerve Complications	1	5%
Pleural Effusion	1	5%
Pneumothorax	2	10%

Comments: The incidence of unexpected effects and complications revealed orthostatic hypotension as the most prevalent, affecting 40% of the participants. Initial pain was reported by 30% of patients, followed by alcohol intoxication at 25% and diarrhea at 15%.

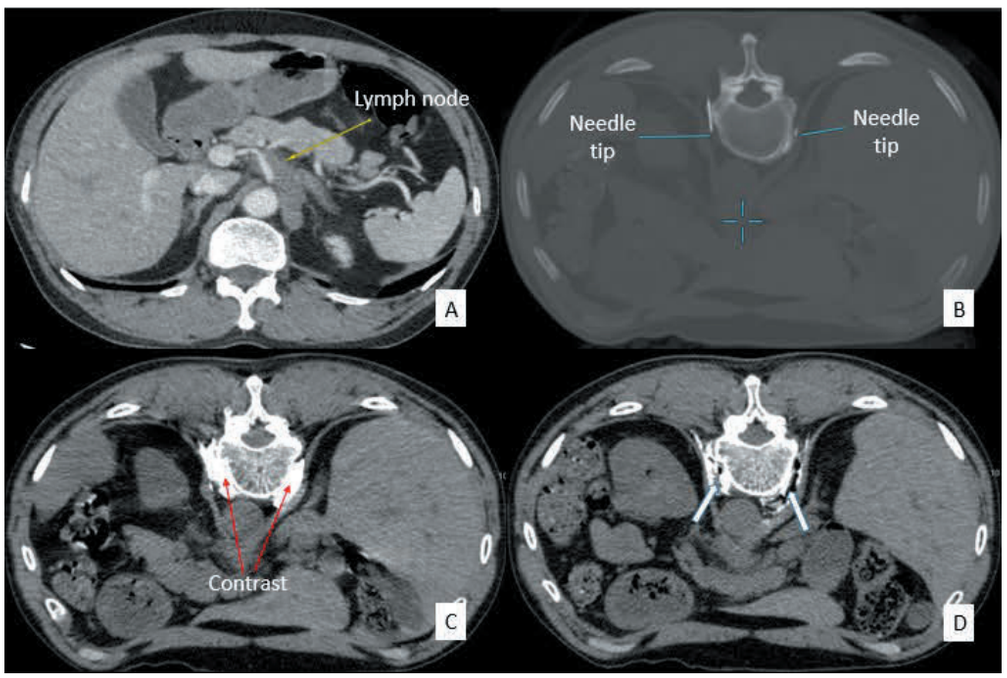

Figure 1. A case study participant of a 56-year-old male diagnosed with lung cancer, post-surgery, featuring a metastatic lesion in the upper abdominal region. The patient initially presented with severe epigastric pain, recording a VAS score of 10 points before the intervention. Following the intervention, the pain subsided significantly, registering at only 1 point on the VAS. A: Depiction of multiple metastatic nodes surrounding the abdominal aorta and along the aortic bifurcation. B: Visualization of the needle tip accurately placed in the upper abdominal region. C: Contrast agent injection for verification purposes, showcasing the contrast agent spreading throughout the upper abdominal region. D: Post-injection of absolute alcohol, displaying a slightly negative density and even distribution from the D10 to D12 levels (arrows). Importantly, no complications were noted in the process.

IV. DISCUSSION

The average age of patients in our study was 60.7±11.1 years, with a male-to-female ratio of 1.5. This result is similar to the study by Fujita et al. in 1993, where the average age was 58 years, with a male-to-female ratio of 1.25 [4]. All patients in our study experienced severe pain or higher before the intervention, with 11 patients (accounts for 55%) having persistent severe pain and 6 patients (accounts for 30%) reporting unbearable pain. Notably, one patient with lung cancer and another with colorectal cancer experienced pain solely due to metastatic lesions. Since the study specifically selected patients with VAS ≥7, enduring pain for more than 3 weeks, and not easily controlled with analgesics alone, the intervention was crucial for pain management. Patients with VAS <7 would be treated with medication.

Intervention guided by CT scans facilitated accurate needle positioning in terms of angle and depth. Most patients achieved good pain reduction one day after the intervention (accounting for 70%), some had moderate efficacy (accounting for 30%), and none showed no effect. This result is lower than Fujita et al.'s study in 1993 with 95.3% of patients experiencing good pain reduction and 4.7% having moderate reduction.[4] One month post-intervention, the majority of patients achieved good efficacy (95%), surpassing a study by Dinh Gia Khanh using the celiac plexus block by using alcohol injected into the anterior of the diaphragm cruses, close to the root of the celiac trunk and the superior mesenteric artery. The average VAS score reduction was substantial: before the intervention, it was 8.7±1.1; one day after the intervention, 3.4±1.3; one week later, 2.6±1.5; and maintained stability after one month, 2.1±1.5. These results align with a study by Complex in 2020 [6]. According to Cariati et al. in 1997, using this technique effectively reduces cancer-related pain if patients are appropriately selected and the technique is performed correctly [7]. Regarding complications and unintended effects, orthostatic hypotension occurred in 8 patients (accounts for 40%), higher than Matsumoto's comprehensive analysis at 31% [8]. The primary cause of orthostatic hypotension is reduced sympathetic function, leading to vasodilation and decreased cardiac output [9]. Symptoms were alleviated by resting in bed for at least 12 hours post-surgery, with fluid infusion to increase circulation. The study's elderly patients with cancer-related debilitation and atherosclerosis naturally alleviated symptoms without treatment. Initial pain was the second most common complication, observed in 6 patients (accounts for 30%), with symptoms like burning or upper abdominal tension immediately after the procedure. Symptoms spontaneously decreased within 48 hours without treatment. This percentage is lower than Subramaniam's study in 2021 with 60% experiencing initial pain [10]. Alcohol intoxication symptoms occurred in over 25% of patients immediately after the procedure, resolving without treatment within a few hours. Diarrhoea was observed in 3/20 cases (accounts for 15%), with spontaneous recovery within a few days, lower than Matsumoto's comprehensive analysis at 28% [8]. Authors attribute this to increased bowel motility due to the sympathetic blockade's effect on the nerve plexus, causing temporary discomfort.

Pleural complications included pleural effusion in 1 patient (accounts for 5%) and pneumothorax in 2 patients (accounts for 10%), all of mild intensity and requiring no treatment. This could be attributed to the use of small needles size 25G, reducing the likelihood of effusion and pneumothorax. However, complications could occur if the needle position shifted during the procedure, leading to fluid or air leakage into the pleural cavity. One patient (accounts for 5%) experienced nerve complications, with paresthesia along the right D12 root causing mild discomfort. Symptoms spontaneously resolved within a week, likely due to the needle contacting the nerve root during the procedure. Severe nerve complications, such as intrathecal or extradural injection, spinal cord injury, disc herniation, bleeding, or infection, did not occur in any patients.

Compared to Dinh Gia Khanh's study [5] using the celiac plexus block method, our study had a lower rate of diarrhea and a higher incidence of alcohol intoxication side effects.

V. CONCLUSION

CT-guided splanchnic nerve neurolysis with absolute alcohol is a safe method that rapidly and consistently reduces pain for up to one month. Common side effects include orthostatic hypotension, initial pain, diarrhea, and alcohol intoxication, but none are severe.

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