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SCIENTIFIC ARTICLE

Subcostal transversus abdominis plane block can improve analgesia after laparoscopic cholecystectomy



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Abstract

Background and goal of study: After laparoscopic cholecystectomy, patients have moderate pain in the early postoperative period. Some studies shown beneficial effects of subcostal transversus abdominis plane block on reducing this pain. Our goal was to investigate influence of subcostal transversus abdominis plane block on postoperative pain scores and opioid consumption.

Materials and methods: We have randomized 76 patients undergoing laparoscopic cholecystectomy to receive either subcostal transversus abdominis plane block ($n=38$) or standard postoperative analgesia ($n=38$). First group received bilateral ultrasound guided subcostal transversus abdominis plane block with 20 mL of 0.33% bupivacaine per side before operation and tramadol $1\text{ mg}\cdot\text{kg}^{-1}$ IV for pain breakthrough (≥ 6). Second group received after operation tramadol $1\text{ mg}\cdot\text{kg}^{-1}/6\text{ h}$ as standard hospital analgesia protocol. Both groups received acetaminophen $1\text{ g}/8\text{ h}$ IV and metamizole $2.5\text{ g}/12\text{ h}$. Pain at rest was recorded for each patient using NR scale (0–10) in period of 10 min, 30 min, 2 h, 4 h, 8 h, 12 h and 16 h after the surgery.

Results and discussion: We obtained no difference between groups according age, weight, intraoperative fentanyl consumption and duration of surgery. Subcostal transversus abdominis plane block significantly reduced postoperative pain scores compared to standard analgesia in all periods after surgery. Tramadol consumption was significantly lower in the subcostal transversus abdominis plane ($24.29 \pm 47.54\text{ g}$) than in the standard analgesia group ($270.2 \pm 81.9\text{ g}$) ($p=0.000$).

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PALAVRAS-CHAVE

Bloqueio subcostal;
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Analgésia;
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Conclusion: Our results show that subcostal transversus abdominis plane block can provide superior postoperative analgesia and reduction in opioid requirements after laparoscopic cholecystectomy.

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O bloqueio do plano transversal abdominal subcostal pode melhorar a analgesia após colecistectomia laparoscópica

Resumo

Justificativa e objetivo: Após a colecistectomia laparoscópica, os pacientes apresentam dor moderada no pós-operatório imediato. Alguns estudos mostraram efeitos benéficos do bloqueio do plano transversal abdominal subcostal na redução dessa dor. Nosso objetivo foi investigar a influência do bloqueio do plano transversal abdominal subcostal nos escores de dor no pós-operatório e no consumo de opioides.

Materiais e métodos: No total, 76 pacientes submetidos à colecistectomia laparoscópica foram randomizados para receber o bloqueio do plano transversal abdominal subcostal (n = 38) ou analgesia padrão no pós-operatório (n = 38). O primeiro grupo recebeu bloqueio do plano transversal abdominal subcostal bilateral guiado por ultrassom com 20 mL de bupivacaína a 0,33% em cada lado antes da operação e tramadol IV (1 mg.kg⁻¹) para controle da dor (≥ 6). O segundo grupo recebeu tramadol (1 mg.kg⁻¹/6 h) como protocolo padrão de analgesia hospitalar pós-cirurgia. Ambos os grupos receberam acetaminofeno IV (1 g/8 h) e dipirona (2,5 g/12 h). A dor em repouso foi registrada para cada paciente usando a escala NR (0-10) nos períodos de 10 min, 30 min, 2 h, 4 h, 8 h, 12 h e 16 h após a cirurgia.

Resultados e discussão: Não houve diferença entre os grupos em relação à idade, peso, consumo intraoperatório de fentanil e duração da cirurgia. O bloqueio do plano transversal abdominal subcostal reduziu significativamente o escore de dor no pós-operatório em comparação com a analgesia padrão em todos os períodos após a cirurgia. O consumo de tramadol foi significativamente menor no grupo bloqueio do plano transversal abdominal subcostal (24,29 ± 47,54 g) que no grupo analgesia padrão (270,2 ± 81,9 g) (p = 0,000).

Conclusão: Nossos resultados mostram que o bloqueio do plano transversal abdominal subcostal pode proporcionar analgesia superior no pós-operatório e redução da necessidade de opioides após colecistectomia laparoscópica.

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Introduction

In ambulatory surgery practice laparoscopic cholecystectomy is very common procedure with usually moderate intensity of pain in the early postoperative period. Although pain is lower than after open cholecystectomy it is still clearly present. Traditional opioid analgesia increases possibility of side effects like nausea, vomiting and sedation and postpone hospital discharge.¹ Different methods as intraperitoneal lavage or port site infiltration of local anesthetic were successfully used in the past years to decrease pain scores and opioid requirements.² Transversus abdominis plane (TAP) block has got a substantial role in postoperative analgesia after abdominal surgery because deposition of local anesthetics in transversus abdominis fascial plane can produce sensory block over the anterior abdominal wall from T7 to L1.³ Many clinical studies reported beneficial effects of TAP but results were mainly connected to lower

abdominal surgery.³⁻⁵ Since the major part of pain after laparoscopic cholecystectomy derives from abdominal wall incisions, some trials investigated TAP block as potential analgesic option. Some studies showed that TAP block can reduce opioid requirements and pain scores but the results were not conclusive enough because many differences in study designs.⁶⁻¹⁰

The ultrasound-guided subcostal transversus abdominis plane block (STAP), first described by Hebbard 2008, is a variation of TAP which successfully solve the problem of unreliable supraumbilical distribution of the block.¹¹ Results obtained in a few small studies showed significantly better analgesia after laparoscopic cholecystectomy compare to traditional opioid analgesia, port-site infiltration and standard TAP.^{2,12-14} Number of patients in this studies is not enough so new prospective studies is still necessary to resolve whether a STAP block is right analgesic choice after laparoscopic cholecystectomy. The goal

of this prospective, randomized study was to evaluate value of subcostal TAP block in reduction of postoperative pain scores and opioid consumption after laparoscopic cholecystectomy.

Materials and methods

This study was performed in the Clinical centre of Vojvodina, Novi Sad, Serbia between February 2015 and March 2016 with approval of Ethics Committee of the Clinical centre of Vojvodina. Signed, informed consent was obtained from 78 ASA I, II and III patients aged 18 to 75 scheduled to for laparoscopic cholecystectomy. Exclusion criteria were blood coagulation pathology, relevant drug allergy, pregnancy, alcohol or drug abuse, chronic opioid use or inability to understand the study protocol. Patients were randomly assigned to receive a subcostal TAP block bilaterally with 20 mL of 0.33% bupivacaine (study group) or standard hospital analgesia protocol (control group).

All patients received a standardized induction regime consisting of propofol ($2.5 \text{ mg} \cdot \text{kg}^{-1}$), fentanyl ($3 \text{ mcg} \cdot \text{kg}^{-1}$) and rocuronium ($0.6\text{--}0.8 \text{ mg} \cdot \text{kg}^{-1}$). Anesthesia was maintained with sevoflurane. Ten minutes before the end of operation, all patients received acetaminophen 1 g IV and morphine $0.1 \text{ mg} \cdot \text{kg}^{-1}$ sc. A standardized postoperative analgesia regime in both groups was acetaminophen 1 g/8 h IV and metamizole 2.5 g/12 h. Patients in the control group received in addition tramadol $1 \text{ mg} \cdot \text{kg}^{-1}/6 \text{ h}$ while patients in STAP group received tramadol $1 \text{ mg} \cdot \text{kg}^{-1}$ on request for pain breakthrough ($\text{NPS} \geq 6$). The operation was maintained using intraperitoneal pressure between 10 and 12 mmHg. After the surgery all patients with moderate to severe nausea received metoclopramide 10 mg, and those who experience vomiting received ondasetron 4 mg IV (insufficient supply of ondasetron in our hospital).

A US-guided STAP block was performed by one anesthesiologist sufficiently experienced with ultrasound-guided blocks before surgical intervention. A US probe (Mindray M5 diagnostic ultrasound system) was placed in the midline of the abdomen, beneath the xiphoid and moved subcostal laterally until the transversus abdominis muscle starts beneath rectus abdominis muscle. After the visualization of neurofascial plane between internal oblique and transversus abdominis muscle at the level of the anterior axillary line a 100 mm, 20G Stimuplex block needle was guided in plane and after aspiration 20 mL of 0.33% bupivacaine was bilateral deposited within the plane.

Postoperatively, patients were 1 h at recovery unit and after that transferred to ward. Pain at rest was recorded for each patient using numeric rating scale – NRS (0–10) at time 10 min, 30 min, 2 h, 4 h, 8 h, 12 h and 16 h after the

surgery was ended. Pain scores were recorded by recovery and ward nurses who usually do them without any knowledge of patient group. Opioid requirements and postoperative nausea and vomiting events were also recorded.

The primary goal of the study was evaluation of differences in pain scores at NR scale after 10 min, 30 min, 2 h, 4 h, 8 h, 12 h and 16 h. Investigation of differences between groups in postoperative opioid consumption and nausea and vomiting events was secondary study goal.

Statistical analysis

For statistical analysis SPSS 20.0 was used. Differences between the groups were analyzed by Student's *t*-test for normal distribution data and the Mann–Whitney *U* test for data without normal distribution. For nonparametric data the chi-square test was used. $p < 0.05$ was considered statistically significant.

Results

This study recruited 76 patients between February 2015 and March 2016. In the STAP group we had more male patients (58%) and in standard analgesia (control) group we had more female (52%). Patient demographics and perioperative data were compared between groups (Table 1). We obtained no statistically significant differences between groups. Concerning intraoperative opioid consumption (fentanyl) we obtained in the STAP group $250 \pm 59.8 \mu\text{g}$ and $232.7 \pm 55.5 \mu\text{g}$ in the standard analgesia group. This made insufficient statistical difference.

The recorded pain scores are in Table 2. The results have shown that patients who received STAP had lower pain scores in the every time period. Following discharge from recovery unit to the ward differences in pain scores stayed clearly present.

We have obtained that tramadol consumption (g) was significantly lower in the STAP group $24.29 \pm 47.54 \text{ g}$ than in the standard analgesia group 270.2 ± 81.9 ($p = 0.000$). Seven patients in the STAP group received one dose of tramadol on request ($\text{NPS} \geq 6$) and two of them request tramadol twice.

The incidence of nausea and vomiting was 21% in the STAP group and 24% in control group. Every group had 1 patient who received ondasetron.

There were no complications from the block procedure like bleeding, intravascular or intraperitoneal injection, infection or local anesthetic toxicity.

Table 1 Patients demographics and perioperative data.

Values	STAP	No STAP	<i>p</i> -Value
Age (years)	49.87 ± 12.74	52.26 ± 15.21	0.41
Weight (kg)	79.86 ± 16.78	80.89 ± 17.34	0.58
Duration of surgery (min)	71.77 ± 16.21	67.91 ± 17.12	0.34
Intraoperative fentanyl (μg)	246.55 ± 58.12	229.31 ± 55.93	0.25

Table 2 Pain at rest after the surgery using NS scale.

Time after the operation	STAP group	No STAP group	p-Value
10 min	2.97 ± 1.98	5.20 ± 2.23	0.000
30 min	3.11 ± 1.52	4.97 ± 1.93	0.000
2 h	3.00 ± 1.69	4.32 ± 1.72	0.001
4 h	2.48 ± 1.37	3.85 ± 1.39	0.000
8 h	1.91 ± 1.50	3.11 ± 1.54	0.002
12 h	1.48 ± 1.26	2.45 ± 1.40	0.003
16 h	1.17 ± 1.12	2.14 ± 1.53	0.004

Discussion

Appropriate postoperative analgesia is always associated with less perioperative stress, better patient satisfaction and reduction of side effects.¹⁵ The importance of good postoperative analgesia after laparoscopic cholecystectomy made introduction of TAP block in this field quite necessary. Ultrasound-guided approach of TAP block in this surgery has become more popular after results of El-Dawlatly et al. Later other studies have tried to revealed its definitive role in the postoperative analgesia but results were inconclusive.^{6-10,16} Meta-analysis made by Zhao showed on 905 patients that TAP block decrease analgesic requirements and pain scores comparing to multimodal analgesia (NSAIDs and opioids).¹⁷ Laparoscopic cholecystectomy was managed in only small number of patients and analgesia regime in the control group was always different. The main problem with TAP block for laparoscopic cholecystectomy was unreliable supraumbilical effects of local anesthetics and insufficient data concerning postoperative analgesia differences between TAP block and local anesthetic port-site infiltration. Study of Tolchard et al. introduce subcostal variation of TAP block (STAP) in the postoperative analgesia after laparoscopic cholecystectomy. Author has correlated STAP with port-site infiltration and obtained significantly better analgesia after STAP.² Shin et al. compared STAP block with TAP and standard analgesia and results confirmed advantage of STAP in pain scores and opioid consumption.¹⁴ Other data have showed intraoperative analgesic potential of STAP.¹³

This data are very promising but still need to be verified with greater number of patients. This is why we have started in the second part of 2014 to perform STAP block for upper abdominal surgery in our hospital. Our investigation about analgesic role of STAP for laparoscopic cholecystectomy has started in February 2015. The obtained results showed significantly better postoperative analgesia in the STAP group in every postoperative time period. Our results significantly correlated with earlier studies.^{2,12,14} Although this studies including ours have differences in study design, three correlated STAP with standard multimodal analgesia and one with port infiltration, obtained data are very comparable concerning prime goal of each study. Our obtained differences in pain scores were more distinct in the early postoperative period but statistical significance was still present through time. Other comparable studies had very similar results concerning gradual decrease of analgesic effect.^{2,12,14} STAP analgesic effect has decreased through time but stayed

clearly present. We were very satisfied with remained analgesic effect of STAP block because lack of ward nurses in our hospital can sometimes postpone analgesia. This is the major reason because tramadol as primal postoperative analgesic is planed not for moment of patients request but for precise postoperative period of 6 h. Only one surgeon in our hospital has performed local anesthetic port-site infiltration and this right on the beginning of investigation denied us opportunity to evaluate differences between STAP and port-site infiltration. His patients were excluded from the study. Lower tramadol consumption in the STAP group confirmed again his potential in the future. This is similar to results of earlier studies although different opioid analgesia was used.^{2,12,14} Meta-analysis of Zhao et al. remained us how difficult is to analyze postoperative analgesia because heterogeneity between multimodal analgesic protocols, but combination between different types of NSAIDs (ketorolac, diclofenac or metamizole) and opioids (morphine, tramadol) is still a standard worldwide.¹⁷ Because of that, we have considered that combination of metamizole and tramadol which is standard analgesic protocol in our hospital can be compared with other data.

Our incidence of nausea and vomiting was very similar in both groups. Some other trials which researched TAP block and laparoscopic surgery revealed significantly bigger incidence in TAP group than control.¹⁷ Traditionally, nausea and vomiting was thought as one of opioid-related side effects, but those findings have opened the new discussion about the real nature. This subject needs more clinical studies to investigate proper connection between TAP block and laparoscopic surgery with nausea and vomiting.

This study has some limitations. First limitation is relatively small number of patients. Second limitation is insufficient use of port-site infiltration in our hospital. This prevented inclusion of third group in the study which could make our findings more significant.

In conclusion we can underline great potential of STAP block. It can significantly improve postoperative analgesia after laparoscopic cholecystectomy. Naturally, a more randomized double-blind study is needed in the future. This new data will define significance of STAP block compared to port side infiltration of local anesthetics for postoperative analgesia after laparoscopic cholecystectomy and future prevalence in different upper abdominal operations.

Conflicts of interest

The authors declare no conflicts of interest.

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