Manual treatment for kidney mobility and symptoms in women with nonspecific low back pain and urinary infections

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Abstract

Context: Recent studies have suggested a connection between low back pain (LBP) and urinary tract infections (UTI). These disturbances could be triggered via visceral-somatic pathways, and there is evidence that kidney mobility is reduced in patients suffering from nonspecific LBP. Manual treatment of the perinephric fascia could improve both kidney mobility and LBP related symptoms.

Objectives: To assess whether manual treatment relieves UTI and reduces pain in patients with nonspecific LBP through improvement in kidney mobility.

Methods: Records from all patients treated at a single physical therapy center in 2019 were retrospectively reviewed. Patients were included if they were 18 years of age or older, had nonspecific LBP, and experienced at least one UTI episode in the 3 months before presentation. Patients were excluded if they had undergone manipulative treatment in the 6 months before presentation, if they had one of several medical conditions, if they had a history of chronic pain medication use, and more. Patient records were divided into two groups for analysis: those who were treated with manipulative techniques of the fascia with thrust movement (Group A) vs those who were treated without thrust movement (Group B). Kidney Mobility Scores (KMS) were analyzed using high resolution ultrasound. Symptoms as reported at patients’ 1 month follow up visits were also used to assess outcomes; these included UTI relapse, lumbar spine mobility assessed with a modified Schober test, and lumbar spine pain.

Results: Of 126 available records, 20 patients were included in this retrospective study (10 in Group A and 10 in Group B), all of whom who completed treatment and attended their 1 month follow up visit. Treatments took place in a single session for all patients and all underwent ultrasound of the right kidney before and after treatment. The mean (± standard deviation) KMS (1.9 ± 1.1), mobility when bending (22.7 ± 1.2), and LBP scores (1.2 ± 2.6) of the patients in Group A improved significantly in comparison with the patients in Group B (mean KMS, 1.1 ± 0.8; mobility when bending, 21.9 ± 1.1; and LBP, 3.9 ± 2.7) KMS, p<0.001; mobility when bending, p=0.003; and LBP, p=0.007). At the 1 month follow up visit, no significant statistical changes were observed in UTI recurrence (secondary outcome) in Group A (−16.5 ± 4.3) compared with Group B (−20.4 ± 7) (p=0.152).

Conclusions: Manual treatments for nonspecific LBP associated with UTI resulted in improved mobility and symptoms for patients in this retrospective study, including a significant increase in kidney mobility.

Keywords: kidney mobility; low back pain; osteopathic manipulation; ultrasound; urinary tract infections.

Low back pain (LBP) has been reported to affect over 70% of the Western industrialized adult population [1] and is the most common reason that patients consult a physician [1, 2], as well as one of the leading causes of absences from work [3–6]. Almost 85% of LBP is nonspecific and cannot be attributed to recognizable ailments such as fractures, compression of nerve roots, infections, neoplastic processes, inflammatory syndromes, or systemic diseases [1]. Sixty-five percent of the affected population still experiences pain 1 year
after the initial onset of symptoms [4]. LBP etiology is multifactorial, thus making the diagnostic and therapeutic process challenging [5]. One possible cause of LBP is urinary tract infections (UTI), which is among the most frequent causes of hospitalization for infection, as well as a prevalent indication for antibiotic treatment in primary care [6, 7]. UTI can involve the upper or lower urinary tract, causing complications like cystitis or pyelonephritis. Frequent symptoms of noncomplicated cystitis are dysuria, suprapubic pain and urgency, while pyelonephritis is characterized by fever, nausea, vomiting, lumbar pain, and upper abdomen pain sensitivity [8, 9]. It has been hypothesized [10] that disturbances in the physiological interface of the visceral organs (which can be observed after surgical treatment [11]) may cause visceral pain, which in turn might be perceived as typical LPB [10, 12].

Smith et al. [10], in fact, described how a large proportion of women in the patient population reported a close association between back pain and visceral disorders, caused by a visceral-somatic pathway where somatic pain is a consequence of the primary visceral pain. The spread of pain in areas other than the affected organ is described as visceral nociception and it is the result of somatic and visceral pain convergence in the sensory neurons.

It has been hypothesized that such disturbances could cause, augment, or maintain musculoskeletal or gastrointestinal complaints, such as LBP or irritable bowel disorder [13]. More specifically, kidney infections could induce referred pain by the sympathetic nervous system (T10–L2), which can be felt on related anterior and posterior dermatomes manifesting in the inner front thigh and groin. Osteopathic treatment of the kidney could reduce these symptoms [14]. Thoracolumbar spinal-visceral afferent nerves relay events that might be interpreted as somatic discomfort. Furthermore, these pathways are part of extra-splanchnic (as well as spinal) reflexes which may possibly affect visceral organs (i.e., heart or kidney) [15–17]. Moreover, there is some evidence that disturbances in the autonomic system could significantly affect the function of the visceral organs [18, 19]. The sympathetic efferent nerves can alter some renal functions, including the release of hormones and possibly sodium and water regulation in the tubuli [20]. On these bases, osteopathic manipulative treatment (OMT) to the visceral organs is predicated on the idea that mobility alterations can be detected by palpation and treated using manipulation [13, 21]. Many techniques are currently utilized by doctors of osteopathic medicine to improve the homeostasis of the affected system through direct manipulation [22]. However, previous evidence on the subject is not conclusive [11]. Tozzi et al. [18] documented a reduction in right kidney mobility in 140 patients with nonspecific LBP; in those subjects, OMT to the perinephric fascia improved kidney mobility (mean ± standard deviation [SD], 11.3 ± 9 vs. 5.8 ± 8.6; p<0.001) immediately after treatment [23].

Relevant fascial connections between the kidney and the surrounding dorsal-lumbar-pelvic structures exist. The thoracolumbar fascia fits medi ally into the anterior surfaces of the lumbar transverse process [24] and joins the iliac and endopelvic fasciae [25]. Some osteopathic techniques, such as liftoff T12–L1, stretching technique of perinephric fascia, and functional kidney balance technique proposed by François Ricard [14], could improve local vascularity and mobility, but there are no studies that have reported their beneficial effects on UTI symptoms.

For this reason, OMT to the kidney is not yet considered a standard treatment option in guidelines for LBP or UTI management [1, 26–28]. It is unclear whether OMT could improve disorders due to UTI, lumbar spine mobility, and pain in patients with nonspecific LBP. In this study, our primary objective was to retrospectively compare kidney mobility outcomes and the frequency of UTI relapses in patients with nonspecific LBP who were treated with or without osteopathic thrust in our clinic. Our secondary objective was to compare pain intensity and lumbar fascia motility in these two groups.

Methods

This study was approved by the Liguria Regional Ethics Committee (REC) and all patients provided written informed consent. All analyses were performed offline (i.e., on a computer not connected to the Internet) and all data were deidentified. Written consent was provided by the individuals shown in the Figures to publish these images.

Study population

Data of all patients who were diagnosed using ultrasound and mobility questionnaires then treated at our institution between January 1, 2019 and December 31, 2019 were reviewed in October 2020. Adult subjects (18 years of age or older) with nonspecific LBP and at least one UTI episode in the 3 months before presenting for treatment were included. Exclusion criteria were as follows: manipulative treatment in the 6 months before treatment; presence of neurogenic bladder; presence of rheumatic disease; ongoing acute infections; peripheral or central paralysis; chronic use of pain medications (e.g., nonsteroidal anti-inflammatory drugs, steroids, opioids); absolute contraindications to the manipulative therapy; absence of kidney imaging at the time of treatment; failure to complete the evaluation questionnaire; failure to
present for the follow-up visit; or failure to provide consent for the inclusion of their deidentified data for research purposes. A flow chart demonstrating application of inclusion and exclusion criteria is provided in Figure 1.

**Interventions**

After retrospective inclusion in the study, patients were stratified according to treatment type. Patients who underwent manipulative therapy with thrust were assigned to Group A, while patients treated without thrust were assigned to Group B. All treatments took place in a single session. An ultrasound on the right kidney was performed before and after treatment, which lasted for 15 min. All participants were advised to continue with their usual pharmacological or non-pharmacological therapies, daily activity, and living habits. The patients in Group A were treated with the following techniques: liftoff T12–L1, the stretching technique of perinephric fascia, and the functional kidney balance technique. The patients in Group B were treated with the same techniques and in the same positions, but without thrust.

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**Figure 1:** Flow chart demonstrating the application of inclusion and exclusion criteria for patients included in this retrospective study.
Descriptions of the three techniques used on patients treated with thrust appear below. All techniques were applied by two physiotherapists (F.L.B. and A.P.) with 5 years of experience.

**Liftoff T12–L1**

*Patient position:* The patient is sitting (Figure 2).

*Practitioner position:* The practitioner is slightly oblique, behind the patient, facing forward.

*Contacts:* The patient is asked to put their open hand on the affected area and the other hand on top of it, with the two hands creating the shape of the letter “V.” The therapist’s chest touches the hands. The forearms go through this triangle formed by arms and torso. Both hands fingers are crossed on the anterior part of the chest at the sternum level.

*Technique:* Cervical and torso flexion is employed, slipping the therapist’s weight on the posterior leg. An anteroposterior compression is induced by inflating the chest and compressing the anterior part through the hands. The thrust is applied by increasing hand compression and then inflating the chest.

**Stretching technique of perinephric fascia**

*Patient position:* The patient is lying on their back; the leg contralateral leg to the treatment side is in flexion, with the foot leaning on the table (Figure 3).

*Practitioner position:* The practitioner, sitting next to the table on the side to be treated, puts the patient’s leg off the table, avoiding any kind of active interaction (e.g., resting on the practitioner’s thigh area).

*Contacts:* The external hand rests on the patient’s thigh; the internal hand, resting on the patient’s stomach, touches with the lower pole of the kidney to be treated.

*Technique:* The hand on the abdomen lifts the kidney and stays as a fixed point; the other hand rhythmically applies tractions caudally to stretch the perinephric fascia.

**Functional kidney balance technique**

*Patient position:* The patient is lying on their back and both legs (in flexion) are resting on the table (Figure 4).

*Practitioner position:* The practitioner is standing or sitting at the patient’s side.

*Contacts:* The practitioner’s hand rests on the patient’s chest at kidney level and compresses towards the table until the organ can be appreciated.

*Technique:* The kidney is balanced functionally, gathering free parameters until the point of equilibrium is reached, which allows
autocorrections of fascial tensions. Balance is kept while the patient breathes deeply in the therapist’s hands.

In Group B, the same techniques were used but thrust was not applied. This approach was used in patients treated in the first period of evaluation (January–April 2019).

Outcomes measurements

Our primary outcome was the detection of any change in right kidney mobility immediately after the treatment, which was measured by the radiologist performing the ultrasound (G.F.). Secondary outcomes were (1) change in lumbar spine mobility during torso bending (immediate effect after treatment); (2) change in pain measured by the VAS in standing or bending position (immediate effect after treatment); and (3) assessment of UTI-associated symptoms (phone inquiry 1 month after treatment). Spine mobility and perceived level of pain were measured by the physiotherapist (A.P.) before and after the treatment.

UTI: UTI relapses were assessed with the UTI Symptoms Assessment questionnaire [32]. Concerns about and severity level of the seven most common UTI symptoms are examined in this questionnaire: frequency and urgency; dysuria (burning and pain); difficulty urinating; pelvic or abdominal pain; sense of weight; LPB; and hematuria. The score for each symptom is recorded on a scale from 0 (no symptoms) to 3 (highest severity and concern) [33]. The questionnaire was administered by the physiotherapist (A.P.) at baseline and 1 month after the treatment with a survey telephone call. At both timepoints, the evaluator registered the perceived symptoms during the 24 h before and the whole previous month.
Lumbar pain perception was assessed using a visual analog scale (VAS); the VAS requires the patient to indicate a point on a horizontal line for which the ends represent extreme and antithetical conditions [35].

Lumbar spine mobility: Lumbar spine mobility in flexion was assessed via the modified Schober test [34]. This test is applied by having the patient stand up straight without shoes, with their feet placed hip distance apart. Using a permanent marker, the examiner notes a distance of 5 cm below and 10 cm above the lumbar/sacral hinge at the posterior superior iliac spine level. The subject is asked to repeat a forward flexion movement (touching their toes) twice, keeping knees and upper limbs as straight as possible; the first try is considered to be practice and a measurement is taken on the second attempt. An increase of distance between marked points indicates an improvement in lumbar flexion [36].

Lumbar pain: Lumbar pain perception was assessed using a visual analog scale (VAS); the VAS requires the patient to indicate a point on a horizontal line for which the ends represent extreme and antithetical conditions [35].

**Statistical analysis**

The characteristics of study subjects were represented through descriptive statistics: mean, SD, and range for continuous variables; absolute frequencies and percentages for categorical variables. The distribution of the variables was tested by the Shapiro–Wilk normality test. Baseline characteristics were compared between groups using the student’s t-test for unpaired data (or Mann–Whitney test if normality was not verified) for continuous variables, and the Chi-Quadro test for qualitative variables. Pre- and posttreatment differences in groups (within-group analysis) were assessed using the parametric Student’s t-test for paired data. Finally, the Mann–Whitney parametric student’s t-test for nonpaired or nonparametric data was conducted to determine whether there were differences in the variation of outcomes between groups (between-group analysis). To reject the null hypothesis (equivalence of the two treatments), p<0.05 was considered statistically significant. All analyses were performed using the XLSTAT statistical software (Addinsoft, version 2018.6).

**Results**

A total of 126 patients were treated at our institution in 2019. After review of the inclusion and exclusion criteria, 20 patients were included in the analysis (10 subjects in the Group A and 10 in the Group B). All included patients were women. Table 1 summarizes the clinical and demographic characteristics of the patients at baseline.

There were no significant differences found between the two groups in terms of demographic characteristics at baseline (Table 1); the two groups differed only in results of the UTI Symptoms Assessment Questionnaire for the previous month: Group A reported a lower frequency of UTI than Group B (mean, 17.9 and 27.3, respectively; p=0.001).

Table 2 summarizes the change in mobility and lumbar pain in each group (within group analysis). A significant change in lumbar pain was found in both groups: lumbar pain improved significantly in both groups (Group A, p=0.001; Group B, p=0.034), while mobility (measured with

**Table 1: Baseline demographic and clinical data.**

<table>
<thead>
<tr>
<th></th>
<th>Total n=20</th>
<th>Group A n=10</th>
<th>Group B n=10</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>46.4 ± 10.3</td>
<td>47 ± 9.6</td>
<td>45.9 ± 11.4</td>
<td>0.818</td>
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<tr>
<td></td>
<td>(27–60)</td>
<td>(30–59)</td>
<td>(27–60)</td>
<td></td>
</tr>
<tr>
<td>Weight, kg</td>
<td>62.4 ± 9.9</td>
<td>65.4 ± 11.1</td>
<td>59.4 ± 8.1</td>
<td>0.108</td>
</tr>
<tr>
<td></td>
<td>(50–85)</td>
<td>(50–85)</td>
<td>(53–77)</td>
<td></td>
</tr>
<tr>
<td>Height, cm</td>
<td>165.1 ± 5.2</td>
<td>166.9 ± 5.3</td>
<td>163.3 ± 4.7</td>
<td>0.126</td>
</tr>
<tr>
<td></td>
<td>(158–176)</td>
<td>(159–176)</td>
<td>(158–170)</td>
<td></td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>22.8 ± 3.1</td>
<td>23.5 ± 3.7</td>
<td>22.2 ± 2.5</td>
<td>0.399</td>
</tr>
<tr>
<td></td>
<td>(17.9–29.4)</td>
<td>(17.9–29.4)</td>
<td>(19.4–26.9)</td>
<td></td>
</tr>
<tr>
<td>Modified schober test</td>
<td>21.6 ± 1.1</td>
<td>21.5 ± 1.2</td>
<td>21.5 ± 1.2</td>
<td>0.709</td>
</tr>
<tr>
<td></td>
<td>(20–23)</td>
<td>(20–23)</td>
<td>(20–23)</td>
<td></td>
</tr>
<tr>
<td>Lumbar pain</td>
<td>5.8 ± 2.3</td>
<td>6.3 ± 2.9</td>
<td>6.3 ± 2.9</td>
<td>0.401</td>
</tr>
<tr>
<td></td>
<td>(2–10)</td>
<td>(2–10)</td>
<td>(2–10)</td>
<td></td>
</tr>
<tr>
<td>UTI symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>assessment questionnaire</td>
<td>5.1 ± 4.5</td>
<td>5.3 ± 3.21</td>
<td>5 ± 5.6</td>
<td>0.885</td>
</tr>
<tr>
<td></td>
<td>(0–15)</td>
<td>(0–10)</td>
<td>(0–15)</td>
<td></td>
</tr>
<tr>
<td>UTI previous</td>
<td>22.6 ± 6.8</td>
<td>17.9 ± 3.8</td>
<td>27.3 ± 5.9</td>
<td>0.001*</td>
</tr>
<tr>
<td>month</td>
<td>(10–39)</td>
<td>(10–23)</td>
<td>(18–39)</td>
<td></td>
</tr>
</tbody>
</table>

Data are reported as mean ± standard deviation (range). BMI, body mass index; UTI, urinary tract infection. *Statistically significant at p<0.05; Student’s t-test for unpaired data; †Chi-square test with Yates continuity correction; ‡Mann–Whitney test.
Data are reported as mean ± standard deviation (range). *Statistically significant at p<0.05; †Wilcoxon row sign test; ‡Student’s t-test for paired data.

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=10</td>
<td>n=10</td>
</tr>
</tbody>
</table>

| Modified Schober test† | 21.5 ± 1.2 (20–23) | 22.7 ± 1.2 (21–24) | 0.004* |
| Lumbar pain†           | 6.3 ± 2.9 (2–10)   | 1.2 ± 2.6 (0–8)    | 0.001* |

Between-group analysis was performed to determine differences in pre- and posttreatment variations between Groups A and B (Tables 4 and 5; Figure 7). The primary outcome measure (KMS) and secondary outcomes (mobility and lumbar pain) showed a significantly higher variation in Group A than in Group B. The mean ± SD difference of mobility was 1.2 ± 0.6 in Group A and 0.2 ± 0.4 in Group B (p=0.003).

We registered a significantly higher reduction of lumbar pain in Group A (mean ± SD, −5.1 ± 3.2) than in Group B (mean ± SD, −1.5 ± 1.9) (p=0.007) and KMS variation was significantly higher in Group A than Group B (p=0.157).

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We registered a significantly higher reduction of lumbar pain in Group A (mean ± SD, −5.1 ± 3.2) than in Group B (mean ± SD, −1.5 ± 1.9) (p=0.007) and KMS variation was significantly higher in Group A than Group B (p=0.157).

<table>
<thead>
<tr>
<th>Variation of outcome between pretreatment and posttreatment values</th>
<th>Group A n=10</th>
<th>Group B n=10</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified Schober test†</td>
<td>1.2 ± 0.6</td>
<td>0.2 ± 0.4</td>
<td>0.003*</td>
</tr>
<tr>
<td>Lumbar pain†</td>
<td>−5.1 ± 3.2</td>
<td>−1.5 ± 1.9</td>
<td>0.007*</td>
</tr>
<tr>
<td>KMS†</td>
<td>1.1 ± 0.8</td>
<td>−0.2 ± 0.3</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

Data are reported as mean ± standard deviation. KMS, Kidney Mobility Score. *Statistically significant at p<0.05; †Mann–Whitney test for unpaired data; ‡Student’s t-test for unpaired data.

Table 5: Urinary tract infection symptoms assessment questionnaire responses.

<table>
<thead>
<tr>
<th>Variation of UTI questionnaire responses</th>
<th>Group A n=10</th>
<th>Group B n=10</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compared to 24 h before the response</td>
<td>−4.9 ± 3.1</td>
<td>−3.3 ± 4.1</td>
<td>0.339</td>
</tr>
<tr>
<td>Compared to one month before the response</td>
<td>−16.5 ± 4.3</td>
<td>−20.4 ± 7</td>
<td>0.152</td>
</tr>
</tbody>
</table>

Data are reported as mean ± standard deviation. UTI, urinary tract infections. †Student’s t-test for unpaired data.

B (mean ± SD, 1.1 ± 0.8 and −0.2 ± 0.3, respectively; p<0.001).

Regarding the questionnaire score comparison between the baseline and the phone interview, no statistically significant differences were found in the variation of symptoms related to UTIs when comparing Groups A and B (Table 5), even with symptoms during the 24 h prior (p=0.339) or the entire month prior (p=0.152).

Discussion

Our data showing a statistically significant improvement in KMS for the group treated with thrust techniques confirmed the results of the study [22] that provided a starting point for this work, which showed that 140 patients with nonspecific LBP had a significant reduction of right kidney mobility compared with 101 asymptomatic people. Furthermore, the
Manipulative treatment of only the perinephric fascia managed to improve both renal mobility and painful LBP symptoms in the short term. Finally, we extended the study with a structural technique of dorsal-lumbar passage thrust, since the nerve fibers directed to the kidney come from the small and inferior splanchnic nerves deriving from the orthosympathetic ganglia of the T12–L1 passage. The secondary objectives related to lumbar pain and mobility were also met. Based on our results, we believe that LBP is related to visceral kidney disorders by the somatic viscera reflex [10] through which somatic pain is the consequence of primary visceral suffering; in fact, the perception of pain in regions other than the affected organ is widespread in visceral nociception as a consequence of somatic and visceral suffering in the same sensory neurons [12]. Therefore, the improvement of pain symptoms through the manipulation of thrust T12–L1, for its neurovegetative and medullary connections, and of the kidney itself, brings an improvement in the lumbar tract mobility by improving vascularization and innervation in the related angiotome, sclerotome, myotome, and dermatome [36]. However, no statistically relevant data were obtained on symptoms related to UTI relapses. According to the UTI Symptoms Assessment Questionnaire, Group A reported a lower frequency of UTI than at baseline, which could have affected the absence of differences at follow-up. Despite these results, all subjects in Group A scored lower at follow-up than at baseline, indicating an improvement in symptoms related to UTI. Ultimately, the treatment of Group A did not affect relapses more than Group B because Group A was less pathological at baseline.

Limitations

This study has some limitations. A small number of subjects were enrolled, but we hope that our results may lead to larger studies. All reviewed patients were women, so the results cannot be applied to men without additional studies. The follow-up period was short, at 1 month posttreatment; it would be interesting to evaluate the results over a longer period with additional follow up visits and intensive treatment protocols. The study’s protocol provided for only one treatment session, whereas a higher number of sessions could be more effective. The two groups were not uniform in previous month UTI symptoms score at the baseline and that may have affected the nonsignificant change in Group A regarding UTI related symptoms at the follow up visit. Finally, the use of ultrasound in the study introduces difficulties for standardization of the measurements due to both operator dependent (probe pressure) and patient dependent (position, tissue mobility, type of breathing) factors.

Conclusions

The use of manipulative techniques in patients with nonspecific LBP associated with UTI significantly increased mobility of the right kidney compared with a control group. The techniques used in this study may be a valuable approach to improve or restore kidney mobility, reduce short term pain perception, and improve lumbar spine mobility in individuals with nonspecific LBP associated with UTI. The results can be a reference point for future researchers to conduct high quality studies with a larger and more diverse patient population, treatments over a longer time period, and long term follow up.

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Author contributions: Ms Cazzaroli, Mr Oliva, Ms Lo Basso, Ms Pilzer, and Dr. Ferrero provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; Ms Lo Basso, Ms Pilzer, Dr. Fiz, and Ms Cazzaroli drafted the article or revised it critically for important intellectual content; Dr Fabbro and Mr Turrina gave final approval of the version of the article to be published; all authors agree to be accountable for all aspects of the work in ensuring that
questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

**Informed consent:** All patients in this study provided written informed consent.

**Ethical approval:** This study was approved by the Liguria Regional Ethics Committee (REC).

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