



Clinical pain research

Lateral Cutaneous Nerve Entrapment Syndrome (LACNES): A previously unrecognized cause of intractable flank pain



Robbert C. Maatman^{a,b,*}, Nicole E. Papen-Botterhuis^a, Marc R.M. Scheltinga^{a,b},
Rudi M.H. Roumen^{a,b}

^a Department of Surgery, Máxima Medical Center, Veldhoven, The Netherlands

^b SolviMáx, Center of Expertise for ACNES, Center of Excellence for Chronic Abdominal Wall and Groin Pain, Máxima Medical Center, Eindhoven, The Netherlands

HIGHLIGHTS

- A common cause for chronic abdominal wall pain is the Anterior Cutaneous Nerve Entrapment Syndrome (ACNES).
- Thoracic intercostal nerves divide in 3 cutaneous end parts: the anterior, lateral and posterior branches.
- Spontaneous neuropathic flank pain can be due to entrapment of lateral branches of thoracic intercostal nerves.
- This condition is coined Lateral Cutaneous Nerve Entrapment Syndrome (LACNES).

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ABSTRACT

Background and aims: Chronic abdominal pain may occasionally be due to terminal endings of intercostal nerves (ACNES, abdominal cutaneous nerve entrapment syndrome) that are entrapped in the abdominal wall. Spontaneous neuropathic flank pain may also be caused by involvement of branches of these intercostal nerves. Aim is to describe a series of patients with flank pain due to nerve entrapment and to increase awareness for an unknown condition coined Lateral Cutaneous Nerve Entrapment Syndrome (LACNES).

Methods: Patients possibly having LACNES (constant area of flank tenderness, small point of maximal pain with neuropathic characteristics, locoregional altered skin sensation) presenting between January 2007 and May 2016 received a diagnostic 5–10 mL 1% lidocaine injection. Pain levels were recorded using a numerical rating scale (0, no pain to 10, worst possible). A >50% pain reduction was defined as success. Long term effect of injections and alternative therapies were determined using a satisfaction scale (1, very satisfied, no pain – 5, pain worse).

Results: 30 patients (21 women, median age 52, range 13–78) were diagnosed with LACNES. Pain following one injection dropped from 6.9 ± 1.4 to 2.4 ± 1.9 (mean, $p < 0.001$) leading to an 83% immediate success rate. Repeated injection therapy was successful in 16 (pain free $n = 7$, pain acceptable, $n = 9$; median 42 months follow-up). The remaining 14 patients received (minimally invasive) surgery ($n = 5$) or other treatments (medication, manual therapy or pulsed radiofrequency, $n = 9$). Overall treatment satisfaction (scale 1 or 2) was attained in 79%.

Conclusions and implications: LACNES should be considered in patients with chronic flank pain. Injection therapy is long term effective in more than half of the population.

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1. Introduction

Flank pain may be defined as a sensation of discomfort that is located in the area between the axilla and iliac bone. Patients with acute flank pain often suffer from an underlying visceral disease such as gallbladder stones or kidney disease. However, chronic flank pain in patients with normal blood and urine tests and

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* Corresponding author at: Department of Surgery, Máxima Medical Center, P.O. Box 7777, 5500 MB Veldhoven, The Netherlands.

E-mail address: solvimax.resurge@mmc.nl (R.C. Maatman).

normal imaging is a diagnostic challenge for general physicians and medical specialists.

The department of General Surgery/SolviMáx has gained ample experience in the treatment of chronic abdominal pain or groin pain of various causes [1–3]. A large portion of these painful patients are found to suffer from a neuropathic pain syndrome of anterior portions of the abdominal wall due to an anterior cutaneous nerve entrapment syndrome (ACNES) [3–6]. It was our impression that a subset of patients who were referred for possible ACNES actually presented with a lateral variant of an ACNES-like pain entity. These individuals reported a neuropathic pain that mimicked ACNES, although the location was far more laterally located in the flank region. As far as we know, only two cases of “entrapped” lateral branches of intercostal thoracic nerves causing flank pain have previously been reported by others [7,8].

The abdominal wall including the flank region is sensory innervated by anterior and lateral cutaneous branches of 6 paired thoracic intercostal nerves (Th 7th–12th) [9,10]. Anterior cutaneous nerve entrapment syndrome (ACNES) is a condition in which terminal (abdominal) parts of these cutaneous intercostal nerve branches are traumatized or triggered by a hitherto unidentified event leading to a local abdominal pain syndrome presenting in the area of the rectus abdominis muscle [9]. Specific ACNES characteristics include a small area (several square centimetres) of maximum pain, altered skin sensation covering this tender point, a positive pinch test and a positive Carnett's test (increased local tenderness by tensing the abdominal muscles) [2,11]. Recently, a novel variant of ACNES was coined Posterior Cutaneous Nerve Entrapment Syndrome (POCNES). This POCNES syndrome is associated with severe localized (lower) back pain, and it was found that posterior branches of the intercostal nerve were entrapped in the region of the thoracolumbar muscle group [12].

The lateral cutaneous branches of an intercostal nerve pass the external intercostal muscles and the serratus anterior muscle towards the flank area. While piercing through these muscles they divide into an anterior and posterior branch (Fig. 1). This piercing site is possibly a preferred location of entrapment of this part of the nerve leading to a typical neuropathic flank pain that we propose to coin lateral cutaneous nerve entrapment syndrome (LACNES). Aim of the present study is to describe a case series of patients who were diagnosed and treated for possible entrapment of lateral branches of intercostal nerves, seen at our institution over the past 10 years.

2. Methods

The present study retrospectively evaluated patients who were analyzed for chronic abdominal wall pain between January 2007 and May 2016 in the department of General Surgery/SolviMáx, Máxima Medical Centre, the Netherlands, a 631-bed teaching hospital. The ethics committee of our hospital approved the study protocol (N17.009). The present study follows guidelines of the declaration of Helsinki (version October 19th, 2013). This manuscript adheres to the applicable STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines [13]. In addition to the present case series, one illustrative patient is reported in greater detail with the clinical picture, pathology findings and intra-operative images to further support the proposed hypothesis of an alleged ‘entrapment neuropathy’ leading to localized neuropathic flank pain.

2.1. Patient selection and inclusion criteria

Surgeons of our hospital have a special interest in patients with chronic abdominal wall pain and groin pain. Outpatient department activities are performed in a centre of expertise (SolviMáx). During

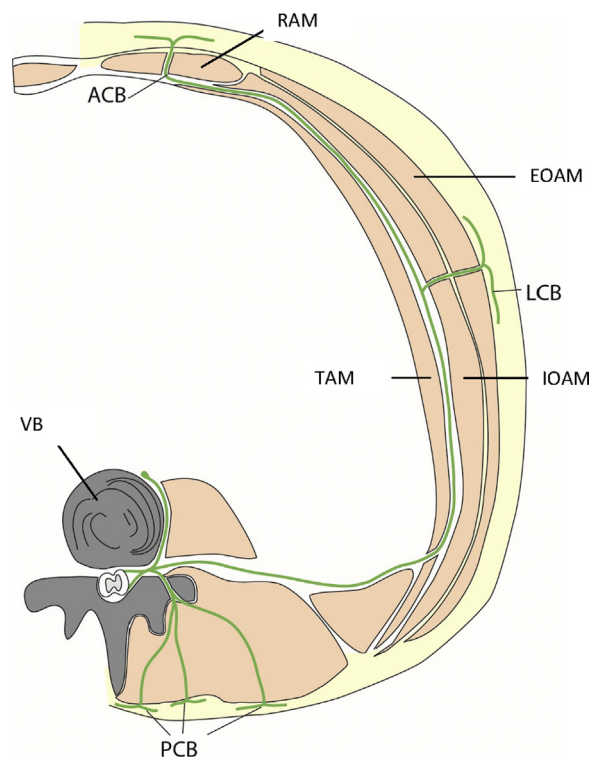


Fig. 1. Anatomy of intercostal cutaneous nerve branch originating from the spinal cord with posterior (PCB), lateral (LCB) and anterior branches (ACB). VB vertebrae, RAM rectus abdominis muscle, EOAM external oblique abdominal muscle, IOAM internal oblique abdominal muscle, TAM transverse abdominal muscle.

the study period, the majority of LACNES patients was identified from a large population of patients presenting to SolviMáx with abdominal pain of unknown origin by two senior authors using a standard history and physical examination [4]. A subset of LACNES patients was diagnosed by one of these senior surgeons at a regular surgical outpatient clinic, occasionally as a follow-up after abnormal visceral imaging.

Physical examination includes a series of standard tests. The patient is asked to indicate the location of maximum pain. A cotton swab and alcohol soaked gauze are used to evaluate skin gnosis and vital sensibility covering this tender point. Somatosensory disturbances such as hypoesthesia, hyperesthesia, allodynia or altered cool perception are commonly found as compared to the contralateral flank. Furthermore, pinching the skin is often extremely painful compared to the opposite non-involved side (a positive Pinch test).

Inclusion criteria for the diagnosis LACNES are based on an extensive (but entirely subjective) experience in patients with ACNES [2,4]. Patients were eligible for inclusion if at least 3 out of 4 of the following criteria were met:

- 1) A >3 month history of locoregional flank pain.
- 2) A constant area of tenderness located in the flank covering a fingertip small point of maximal pain in the midaxillary line (Fig. 2).
- 3) A larger area of altered skin sensation such as hypoesthesia, hyperesthesia or altered cool perception covering this maximal pain point, but not necessarily corresponding to a specific complete dermatome.
- 4) A positive Pinch test (using thumb and index finger to ‘pinch’ and lift the skin around the tender point eliciting a painful response in comparison to the contralateral side).



Fig. 2. A patient with LACNES. The point of maximal pain (swab) is located in the right midaxillary line that is covered by an area of altered skin sensation (/////), hyperesthesia, altered cool perception and positive pinch test. (Photos with permission).

Normal laboratory testing and imaging (ultrasonography, computed tomography) contributed to consideration of the diagnosis LACNES, but was not required per se. Exclusion criteria were surgical scar-related pain syndromes, thoracolumbar disease or impaired communication.

If diagnostic criteria were satisfied, the presumptive diagnosis LACNES was communicated to the patient and specifics of a diagnostic injection procedure were explained. Following verbal consent, 5–10 mL of 1% lidocaine was administered as follows. The exact amount of administered anaesthetic agent was based on the presumed weight of patients and/or the estimated thickness of subcutis covering the tender point. The patient was asked to sit or stand with a raised ipsilateral arm. After skin disinfection, the point of maximal pain was marked with a pencil. A 21 G 40 mm needle was used to administer the lidocaine. Needle tip placement was done 1–2 cm below the fascia of the external oblique muscle or serratus muscle, in proximity to the tender point using a free hand technique (Fig. 3).

2.2. Data accrual and outcome measurements

Pain was measured on a numerical rating scale [NRS, 0 (no pain) to 10 (worst possible pain)] immediately before and some 10–15 minutes after the injection. If levels of pain were considerably lower (e.g. >50% pain reduction), characteristics of the diagnosis were again communicated, and the patient received a control appointment after 2–3 weeks. If the pain had recurred by then, a combination of 5 ml of 1% lidocaine and 40 mg of methylprednisolone was injected. If levels of pain after this regimen

remained unacceptable or if patients declined ongoing injection therapy, they were either referred to a pain clinic for alternative treatments such as medication, physical therapy, manual therapy or pulsed radiofrequency therapy (PRF) or treatment of a visceral source (if present) was performed. A hospital electronic search using a diagnosis code exclusively assigned to abdominal wall related pain syndromes was performed for identification of potential patients. All records were consequently identified and searched to identify individuals suspected of having a neuropathic pain syndrome in the flank. Specifics including age, gender, body mass index, diagnostic delay, aetiology and NRS scores (if present) at baseline and time of follow-up.

A final follow-up evaluation was performed by the first author (RM) in July and August 2016 by phone assessing long-term clinical success and level of satisfaction as previously published (verbal rating scale, VRS, Table 1) [4]. Clinical success was defined as VRS 1–2 ([very] satisfied), while a VRS of 3 was defined as an attenuation of pain levels. The therapy had failed if a VRS 4–5 was reported.

Table 1

Level of satisfaction after treatment for ACNES using Verbal Rating Scale^a (4).

1	I am very satisfied; I have no pain anymore.
2	I am satisfied; I occasionally experience some pain.
3	I have improved, but experience some pain on a regular basis.
4	The treatment did not change my pain level.
5	My pain has worsened after the treatment.

^a After Boelens et al., Ann Surg, 2013. (4).



Fig. 3. Free hand tender point-infiltration using 1% lidocaine combined with 40 mg of methylprednisolone.

2.3. Data analysis

All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 21 for Windows. Categorical variables were described as frequencies. Continuous data were tested for normality and are presented as means with standard deviation ($\pm$ SD) or median values (range) as appropriate. Changes in pain scores after lidocaine infiltration were evaluated using paired T-testing. A *p*-value of <0.05 was considered significant.

3. Results

3.1. Baseline patient characteristics

Thirty patients evaluated in MMC's Department of General Surgery and SolviM ax retrospectively fulfilled inclusion criteria of LACNES during the almost 10 year study period. Characteristics are listed in Table 2. There were 21 (70%) females and 9 (30%) males. Median age was 52 years (range, 13–78). Patients were referred after a median 18 months (range, 3–360), indicating the long duration of this pain entity. Flank pain was more often located on the right than on the left side (80%, 24/30 vs 20%, 6/30). A positive skin pinch test was detected in 90% (27/30). All 30 patients had undergone imaging (e.g. US, CT or MRI scan) to exclude organic disease. Interestingly, underlying visceral abnormalities were demonstrated in nine (liver adenoma (*n* = 2), liver cyst (*n* = 3), a spontaneous/congenital intrahepatic porto-caval shunt (*n* = 1); splenic cyst (*n* = 1) and kidney cyst (*n* = 1) and multiple gallstones (*n* = 1)). An expectative policy was used in the patients with liver cysts, porto-caval shunt and gallstones.

3.2. Diagnostic and therapeutic injections for LACNES

Interventions for LACNES are depicted in Table 3. All patients consented to a diagnostic maximal pain point lidocaine infiltration. In these 30 patients, mean pre- and post-NRS scores were found to drop from 6.9 ± 1.4 to 2.4 ± 1.9 (*p* < 0.001). Twenty five (83%) reported a >50% pain reduction following the diagnostic injection (Fig. 4).

After this single diagnostic injection, 5 of the injected 30 patients (17%) were pain-free in the short term (median one month) as well as in the long term (median 60 months, range 2–103). Two additional patients were long term pain-free after 1–3 repeated injections (respectively 36 and 55 months FU). Thus, 7 of 30 (23%) were long term pain free by an injection regimen only (VRS = 1). Another nine patients reported substantial pain relief in the short term and opted for incidentally repeated injections, if required. Pain levels in this subset were acceptable in the long term (median 24 months, range 2–52; VRS = 2). As a consequence, the overall long

Table 2
Characteristics of patients with lateral cutaneous nerve entrapment syndrome (LACNES).

	LACNES (<i>n</i> = 30)
Age (range)	52 (13–78)
Gender, F:M ratio	21:9
Body mass index, kg/m ² (SD)	23.7 (5.1)
Diagnostic delay, months (range)	18 (3–360)
Aetiology (<i>n</i>)	
Spontaneous	21
Previous abdominal surgery	8
Sports	1
Local sensory dysfunction covering pain point	24
Pain level at presentation (NRS, 0–10)	6.9 (1.4)

Data are presented as mean with standard deviation ($\pm$ SD), or median values with ranges. NRS, Numerical Rating Scale.

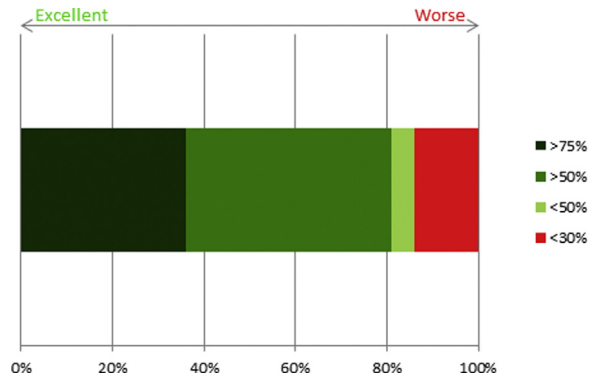


Fig. 4. Pain reduction before and after a diagnostic injection in LACNES.

term injection therapy success rate was 53% (16/30). Two patients received manual therapy simultaneously with injection therapy but they attributed pain relief to injections rather than to manual therapy. One patient who had short-term success with injection therapy experienced a recurrence of pain and was referred to a manual therapist leading to attenuated pain levels (VRS 3).

3.3. Alternative therapies for LACNES

Of the fourteen patients who did not successfully respond to injection therapy, six were referred to a pain service for medication or pulsed radiofrequency therapy (PRF) which led to acceptable pain levels in two (VRS 2). The other four still had residual pain at the final evaluation. Three other patients were referred to a manual therapist, with one achieving acceptable results (VRS 2).

Surgery was performed in the 5 remaining patients. Drainage of a spleen cyst (*n* = 1) and kidney cyst (*n* = 1) as well as embolization of a liver adenoma (*n* = 1) cured the neuropathic flank pain in all three. The fourth patient was referred to an academic hospital for embolization of liver adenoma but the pain remained (VRS 4). Therefore, visceral treatment had a 75% success rate (3/4; VRS 1–2). One patient receiving a neurectomy is described in more detail as follows.

3.4. Case report

A 23-year old female presented with an 18 month history of flank pain located at the right mid-axillary region. Her complaints had presented spontaneously and were slowly progressive leading to a continuous stabbing pain that was provoked by physical effort. Diagnostics and treatments by an orthopaedic surgeon and a neurologist were to no avail. She also received TENS treatment, PRF treatment and cryoneuro ablation by a pain specialist but also without relief. Analysis by this pain specialist showed a DN4 (Douleur Neuropathique 4) score of 5, suggesting a neuropathic character of her pain symptoms. Physical examination revealed a constant area of hypoesthesia of approximately 5 × 5 cm overlying a small point of maximum pain located at the anterior axillary line at the level of the right seventh rib. Two Ultrasound guided infiltrations using local anaesthetics had a beneficial albeit temporary response. Following an extensive consultation, a local surgical exploration was proposed and consented. Prior to operation, the area of interest was marked onto the skin. Once general anaesthesia was administered, the sheath of muscle or serratus anterior was exposed via a transverse 7-cm skin incision. The neurovascular bundle was identified. The fascia was widened and this bundle and its branches were tracked down until it reached the caudal border of the rib edge and was consequently coagulated and removed (Fig. 5). Accompanying vascular structures were ligated or also coagulated. The

Table 3
Characteristics and Success of Interventions in LACNES patients ($n = 30$).

Patient characteristics				Dx Injection		Treatment				Follow-up		
Pt	Age	Location	Pain area in corresponding dermatome	NRS pre	NRS post	Number of injections	MT	PS	Treatment visceral source	Neurectomy	Success IT ^a	Final VRS ^b
1	72	Right	Th10	–	–	1					Yes	1
2	57	Right	Th10	7	0	1					Yes	1
3	50	Right	Th9	9	4	4					Yes	1
4	51	Right	Th9	4	0	3					Yes	2
5	42	Right	Th8	4	0	1	X				Yes	1
6	13	Left	Th9	–	–	1	X				Yes	2
7	66	Right	Th9	5	0	3		X			No	2
8	50	Right	Th11	6	2	1		X			No	2
9	46	Right	Th11	–	–	1					Yes	1
10	52	Left	Th10	8	4	1	X				No	2
11	32	Right	Th9	8	3	2					Yes	1
12	71	Right	Th7	–	–	3					Yes	2
13	78	Right	Th11	5	3	3					Yes	2
14	55	Right	Th12	7	3	4			X		No	1
15	26	Left	Th7	8	2	1			X		No	1
16	71	Right	Th9	8	0	3					Yes	2
17	58	Right	Th8	7	3	2			X		Yes	1
18	48	Right	Th9	6	5	2					No	2
19	59	Right	Th9	9	4	5					Yes	2
20	48	Left	Th8	8	0	1					Yes	1
21	54	Right	Th9	7	3	1					Yes	2
22	64	Right	Th11	6	2	2					Yes	2
23	23	Right	Th7	8	3	2				X	No	2
24	47	Left	Th11	–	–	1		X			No	4
25	55	Left	Th7	6	0	4	X				No	3
26	52	Right	Th10	7	5	1		X			No	4
27	52	Right	Th8	8	6	2	X				No	4
28	68	Right	Th11	8	4	2		X			No	4
29	30	Right	Th11	–	–	1			X		No	4
30 ^c	61	Right	Th8	–	–	1		X			No	^c

Dx diagnostic, IT injection therapy, MT manual therapy, PS pain specialist, NRS Numerical Rating Scale pre/post injection. – Missing data.

^a Success injection therapy is defined as >50% reduction of pain during >6 weeks.

^b Long term success at FU is defined as attaining final VRS 1 or 2 (corresponding with >50% pain reduction, $n = 23$) after receiving one or more interventions.

^c Patient passed away before final follow-up.

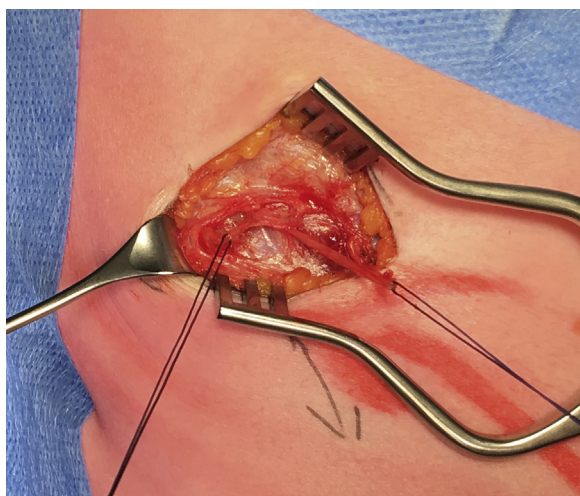


Fig. 5. Intraoperative view of a neurovascular bundle (loop) and a nearby branch (loop) perforating the fascia of the serratus muscle. Point of view: inframammary on the right side of the supine patient. Black arrow pointing caudally showing the irradiation route of pain that was described by the patient.

sheath and the remainder of the wound were closed in layers using absorbable suturing material. Pathological analysis revealed normal nerve tissue. The patient was pain free at the 6 weeks postoperative outpatient control and remained up to the last control (6 months follow up).

3.5. Long term treatment satisfaction

A 100% response rate was attained after a median 40 months follow-up in the surviving 29 patients (range 2–103). One patient died of unrelated cause. More than three quarters (79%, 23 of 29) were satisfied with the therapeutic result (VRS 1–2). One patient (4%) reported improvement but regularly experienced pain (VRS 3). Therapy was unsuccessful in the five remaining patients (17%, VRS 4). No VRS 5 was scored.

4. Discussion

The present retrospective case series found that a small portion of patients who were referred to a tertiary referral centre for evaluation of a chronic abdominal pain syndrome were found to suffer from (possible) neuropathic pain in the flank. These patients demonstrated pain characteristics resembling ACNES although the point of maximal pain was situated far more laterally [4]. Aim of the present study was to describe a series of these patients who were diagnosed and treated for a possible entrapment of intercostal flank nerves. The most important finding is that this novel syndrome should be considered in the differential diagnosis of chronic flank pain. Injection therapy using a combination of local anaesthetic agents with or without steroids appeared long term effective in a little over half (53%) of the population. We propose to coin this syndrome lateral cutaneous nerve entrapment syndrome (LACNES).

It may well be that the set of symptoms of the present cases who are labelled as LACNES was previously described by others using different terminology. In the available literature, one case report

was found describing a lateral cutaneous nerve entrapment syndrome [8]. Another case report described a case of ACNES although the pain actually was located more laterally in the flank [7]. More recently, a posterior version of ACNES was identified suggesting involvement of posterior branches of cutaneous intercostal nerves at the lower back [12]. The present study is the first case series reporting on specific features of entrapment of lateral branches of intercostal nerves that also discusses diagnostic and treatment protocols.

If one proposes a novel syndrome, a clear set of criteria is needed. All patients demonstrated a clinical picture that was characterized by a constant site of lateral abdominal tenderness located in the flank (mid axillary region between the costal arc and the iliac crest) with a fingertip small tender point (Fig. 2). Moreover, most (90%) had a positive pinch test defined as a disproportionately intense pain following skin pinching using thumb and index finger compared to the opposite flank. Similar to ACNES, the pain is accompanied by skin somatosensory disturbances (hypoesthesia, hyperesthesia, hyperalgesia and altered cool perception) that is limited to a discrete area in the flank, indicating some kind of local nerve involvement. In each future patient fulfilling these criteria, the presumptive diagnosis of LACNES should be considered and a diagnostic injection should be offered.

Abdominal cutaneous nerve entrapment syndrome is considered as an “entrapment” neuropathy of cutaneous branches of the 7–12th intercostal nerves [9]. Neuropathic pain has been defined by the International Association for the Study of Pain (IASP) as pain caused by a (demonstrable) lesion or disease of the somatosensory nervous system [14]. A local neurectomy of the lateral cutaneous nerve branch in one patient resulted in complete and long lasting pain relief. A tissue analysis demonstrated normal nervous tissue. This finding supports the hypothesis that entrapment of cutaneous branches of intercostal nerves may possibly lead to a severe neuropathic flank pain entity.

It is remarkable that treatment of a visceral entity cured the neuropathic flank pain in 3 of 4 LACNES patients having parenchymal disease including liver, kidney and spleen. It is thought that a segmental relation between a visceral abnormality and the abdominal wall may explain somatosensory abnormalities and neuropathic pain of the latter. Such connections were described already more than one century ago by Head (“Head zones”) and MacKenzie [15,16]. MacKenzie proposed the term ‘referred pain’ that was defined as pain originating from internal organs that is projected onto a predictable skin area. Relevant to this discussion is an often cited theory that hypothesizes the presence of viscerocutaneous reflexes. Visceral afferent nerve fibres converge with cutaneous pain afferents at the level of the dorsal root ganglion and spinal cord [15–17]. Higher brain centres are possibly not able to distinguish neuropathic abdominal wall pain from visceral pain. One of the senior authors (RR) is also a liver surgeon skilled in the treatment of a range of liver pathologies. His subspecialty has likely contributed to the identification of neuropathic pain symptoms located in the right upper midaxillary line. The somewhat peculiar combination of visceral abnormalities and coinciding neuropathic pain strongly supports the presence of these segmental relations that modern-day clinical medicine, with its focus on high tech imaging, tends to ignore.

Most patients in our study were referred after a median of more than one and a half year diagnostic delay suggesting that this lateral variant is also frequently overlooked as a cause of chronic flank pain as also has been observed in other types of chronic abdominal wall pain [18–20]. However, there exist some differences between the abdominal myofascial pain syndrome (AMPS) and ACNES [18,21–23]. Contrary to ACNES, skin pinching in AMPS is usually normal, as is the local skin sensibility covering the painful area. Moreover, gender distribution is almost equal

(females: males = 54:46) [22]. It is thus unlikely that the beneficial effect of the local injections can be seen as placebo effect. It is hoped that the present study contributes to an earlier recognition of patients with LACNES.

This study obviously harbours flaws including its retrospective character. It describes a patient series with a relatively small volume that is collected over a 10 years period by a selected group of clinicians. Referral bias is present due to the nature of our institution. Different types of treatment were proposed due to lack of knowledge in the early years of this case series. A standardized treatment regimen should prospectively be evaluated in future studies of flank pain. Furthermore, the diagnosis LACNES was not demonstrated by objective tests that are associated with somatosensory disturbances including laser evoked potentials, nerve biopsies (except the single operative case), Quantitative Sensory Testing or MRI imaging [24]. We also did not standardly use specific questionnaires suggesting neuropathic pain, like DN-4, LANSS, Pain DETECT, or the Neuropathic Pain Syndrome Inventory [24]. Nevertheless we feel confident that the patients presented in this series were having neuropathic pain due to affected branches of intercostal nerves as also reported in similar syndromes such as ACNES and POCNES [4,12]. We are currently considering wider deployment of performing a neurectomy of the affected nerve as was done in the presented case, and as has previously been described in patients with recalcitrant ACNES [2,25].

In conclusion, lateral cutaneous nerve entrapment (LACNES) should be considered in the differential diagnosis of chronic flank pain. Injection therapy using a combination of local anaesthetic agents with or without steroids is long term effective in over half of this population. Further research is needed to establish a standardized treatment protocol and investigate the effect of a local surgical exploration in treating LACNES patients.

Author contributions

RM acquired and analysed the used data and drafted the manuscript. NB participated in analysing used data and critically revised the manuscript. MS participated in the design of the study and critically revised the manuscript. RR participated in the design of the study and critically revised the manuscript. All authors discussed the results and commented on the manuscript.

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Ethical issues

The ethics committee of our hospital approved the study protocol (N17.009). The present study follows guidelines of the declaration of Helsinki (version October 19th, 2013).

Conflicts of interest

None declared.

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