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Orchialgia After Living Donor Nephrectomy: An Underreported Entity

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Background. Laparoscopic donor nephrectomy (LDN) offers advantages to the donor. The reported incidence of testicular pain after LDN varies in the literature ranging from 3% to 55%. **Methods.** A survey was sent to 322 male LDN patients who donated from February 5, 2009, to February 5, 2019. The survey assessed if the donor had testicular pain or saw an additional medical professional after donation. **Results.** Of the 322 surveyed, 147 (46%) responses were received. Of those who had a left nephrectomy, 39% had testicular pain; 23.8% of those patients had testicular swelling in addition. Of those who had pain, laterality of kidney donated did not impact if the patient had pain, pain onset, pain level, or pain duration. Of those who donated their right kidney, 35% had testicular pain, and 16.7% of those patients reported testicular swelling in addition. Twenty-seven symptomatic patients sought additional medical care for the testicular symptoms postdonation. Seven (25%) had hydroceles, 2 (7%) had testicular cysts, 1 had a urinary tract infection, and 16 (59%) had reassurance or no additional procedures provided. **Conclusions.** Our results suggest that orchialgia is not as uncommon as previously thought and may be one of the most common minor complications experienced by male donors.

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INTRODUCTION

A living kidney donor (LD) undergoes a major operation without physical benefit. When considering donation,

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candidates should be knowledgeable about the potential risks of LD nephrectomy. Although numerous studies and reviews provide an overview of potential LD risks (bleeding, infection, injury to surrounding structures),¹ the risk of testicular complications, most commonly pain and swelling, is rarely mentioned.

Our center has a long-standing LD follow-up program in which donors are surveyed at regular intervals. However, the development of testicular complications had never been specifically queried. Clinically, we noted that this was not an unusual complication, and designed a survey to study the incidence and severity of postoperative testicular symptoms.

MATERIALS AND METHODS

Donor Survey

Detailed descriptions of the University of Minnesota living donor cohort have been published.² LDs were screened to be healthy at the time of evaluation, including no evidence of proteinuria, hypertension (HTN), or diabetes mellitus (using existing definitions at evaluation) and, historically, body mass index (BMI) ≤ 30 kg/m² unless physical examination results warranted acceptance. Recently, non-Black candidates older than 55 who have well-controlled HTN and no evidence of end-organ damage have been accepted as LDs. In addition, the BMI criterion was raised to ≤ 35 kg/m² unless physical examination results warranted acceptance.

Before 2003, LDs were surveyed intermittently. In 2003, all LDs were contacted to be surveyed and asked to consent to be surveyed every 3 y. As part of the survey, LDs are asked to provide information about their health, including recent

creatinine measurements and development of HTN requiring medication, diabetes mellitus requiring treatment (diet/oral hypoglycemic agent/insulin use), and cardiovascular disease (defined as coronary artery disease/angina; myocardial infarction, angioplasty, or stents; congestive heart disease/failure; and cerebrovascular accident or transient ischemic attack stroke). LDs are also asked to provide copies of their medical records or provide consent to contact their clinics for laboratory results, medical history, and physical examination notes.

The most recently collected survey is cross-validated with previous survey responses. Information about health problems is also obtained from medical charts, if provided. For this study, we use the earliest date of reported problem as indicated on a survey, medical charts, or clinical follow-up. If the date of onset is not provided, the first date the condition was known to the survey team is used as date of onset.

Study Cohort

Between 2009 and 2019, we did 789 living LD nephrectomies; of these, 322 LDs were male. All 322 LDs had hand-assisted laparoscopic nephrectomy (LDN). During the procedure, for both left and right nephrectomy, the gonadal vein (GV) is ligated at the level of the pelvic brim. The ureter is usually divided immediately before vascular stapling after crossing the iliac artery.

Survey

The 322 male LDs were mailed a survey consisting of 9 questions regarding postoperative testicular pain (Figure 1). The donor was first asked if he experienced postoperative testicular pain. For those without pain, there were no further questions.

For those who reported pain, follow-up questions assessed pain onset, pain level on a 10-point scale, pain duration, whether the donor sought medical evaluation, and whether the donor would choose to donate again. The responses were merged with other demographic data routinely collected, including the donor's age at donation, weight, height, BMI, and laterality of kidney removed. The LD database and the testicular pain survey were approved by the University of Minnesota Institutional Review Board (HSC no. 0301M39762).

Statistical Analysis

We compared demographics of those who did versus did not report pain after donation. We then compared those undergoing left versus right nephrectomy. A *t*-test was used for continuous variables and a chi-square or Fisher test for categorical variables. All analysis was performed in R, version 4.0.2.

RESULTS

Of the 322 LDs surveyed, 147 (46%) responded. Of the 147, 113 (77%) donated their left kidney and 34 (23%) their right (Table 1). Orchialgia was reported by 56 (38%) LDs, 44 (39%) of those donating their left kidney and 12 (35%) of those donating their right. There was no statistical significance between patients who did and did not report pain in terms of age, weight, BMI, and laterality of the kidney donated. Patients having pain were taller than those without pain by 4 cm ($P=0.008$) (Table 1).

There was no difference in the incidence of pain, pain onset, or the level or duration based on the laterality of the kidney.

Of the 44 having pain after left nephrectomy, 10 (24%) also reported swelling in the comments section of the survey. For those who developed pain, maximum pain on average was rated a 4 of 10 with a range of 2 to 9 on a 10-point scale. Of those having pain, onset occurred immediately postdonation in 22.5%, 1 to 7 d postdonation in 27.5%, 8 to 14 d postdonation in 20.0%, and >14 d postdonation in 30%. Thirty-two (76%) reported pain in the left testicle, 4 (10%) in the right testicle, and 6 (14%) in both. Maximum pain was reported to last on average 14 d (range 1–365 d); additional medical evaluation was sought by 23 (52.3%) of those with pain after left nephrectomy (Table 2).

Of the 12 having pain after right nephrectomy, 2 (17%) also reported swelling in the comment section. For those who developed pain, maximum pain on average was rated a 4 of 10 with a range of 2 to 8 on a 10-point scale. Of those having pain, onset occurred immediately postdonation in 9%, 1 to 7 d postdonation in 36%, 8 to 14 d postdonation in 27%, and >14 d postdonation in 27%. Nine (81%) felt pain in the right testicle, 1 (9%) in the left testicle, and 1 (9%) in both. Maximum pain was reported to last on average 28 d (range 1–365 d); additional medical evaluation was sought out by 4 (33%) LDs (Table 2).

Additional Medical Care

Twenty-seven symptomatic LDs (16% of LDs; 48% of those with pain) sought additional medical care for postdonation orchialgia (Table 3). Of the 27, 7 (25%) were diagnosed with hydroceles, 2 (7%) with testicular cysts, 1 (4%) with a urinary tract infection, and 1 (4%) with nerve damage. The remaining 16 (59%) had no specific diagnosis. Of those diagnosed with a hydrocele, 2 had hydrocelectomy, 1 had hydrocelectomy and denervation of the spermatic cord, 2 had drainage of hydrocele, and 2 had no procedures (Table 3).

Donate Again

Patients who reported orchialgia were also surveyed about, if they were to go back, would they donate again. Forty-six (82%) said they would definitely donate again, 6 (11%) said they would probably donate again, and 2 (4%) said they were not sure. No patients said they would definitely not or probably not donate again. Patients were given an opportunity to write in additional comments; multiple put how blessed they were to have the opportunity to donate and do not regret their decision even if they had orchialgia.

DISCUSSION

Orchialgia is rarely reported as a complication of laparoscopic donor nephrectomy (LDN). For example, in a recent review and meta-analysis, Kortram et al reported that 7% of those undergoing LDN had complications; but when listing specific complications, testicular pain was not mentioned.¹ Yet, of the 147 LDs responding to our survey, 56 (38%) reported postdonation orchialgia. Of those who had pain, laterality of the donated kidney did not impact pain incidence, timing of pain onset, level, or duration. The decision to utilize a survey-based approach to data collection for this study was based on the belief that a more accurate incidence may be achieved by making sure the question was asked directly as opposed to relying on clinic visits where it was unclear if the

Testicular pain following living kidney donation

(Answer the questions by parking an X in the box that best describes your answer or filling in the blanks as directed)

1. **Since donating your kidney have you ever experienced any pain**
 No → Thank you. We do not have any additional questions at this time
 Yes (please answer questions 2-10)
2. **If yes, which testicle had pain?**
 Left Right Both
3. **Approximately when did the pain start?**
 Immediately after the donation
 1-7 days after donation
 8-14 days after donation
 More than 14 days after donation
 →Please provide approximate start date: ___/___/___ (MDY)
4. **Check the box below that best describes the maximum amount of testicular pain you experienced at any point since donating your kidney:**

0	1	2	3	4	5	6	7	8	9	10
<i>No pain</i>		<i>Mild</i>		<i>Moderat</i>		<i>Severe</i>		<i>Very Severe</i>		<i>Worst Possible</i>

5. **How long did the maximum pain last? _____ days (provide answer in total number of days)**
6. **Did you ever see a medical professional for the pain?**
 No Yes If yes, what did they do?
7. **Do you continue to have testicular pain at this time?***
 No →When did it approximately stop? ___/___/___ (MDY)
 Yes →Check the box below that best describes the amount of pain you are currently experiencing:

0	1	2	3	4	5	6	7	8	9	10
<i>No pain</i>		<i>Mild</i>		<i>Moderat</i>		<i>Severe</i>		<i>Very Severe</i>		<i>Worst Possible</i>

8. **If we have additional questions, may we contact you again regarding this?**
 No Yes
9. **If you could do it over again, would you donate again?**
 Definitely yes Probably yes Not sure Probably not Definitely not
10. **Additional comments**

FIGURE 1. Survey questions mailed to male living donor nephrectomy donors.

question was asked. In addition, surveys allowed the patients to share information in a manner that may make it more comfortable for them to discuss such a sensitive topic.

Previous studies have reported orchialgia in 1% to 44% of males after LDN (Table 4).³⁻¹¹ In each of these studies, the pain

was typically on the same side as the nephrectomy. There are a number of possible explanations for the differing incidence in these reports, including operative technique, specifically questioning the patient about testicular pain, or small study size. Some patients may not think to report such a symptom

TABLE 1.**Comparison of characteristics of patients who did and did not experience testicular pain after live donor nephrectomy**

	No pain after donation (n = 91)	Pain after donation (n = 56)	P
Age at donation, y	49.31 [22.83, 71.90]	46.91 [21.97, 70.24]	0.240
Height, cm	179.00 [168.00, 192.00]	183.00 [163.00, 198.00]	0.008
Weight, kg	87.00 [60.78, 111.36]	87.82 [66.22, 112.50]	0.447
BMI, kg/m ²	26.85 [21.10, 35.15]	27.03 [21.10, 33.48]	0.592
Left kidney used	22 (24.2)	12 (21.4)	0.855

Values are mean [range] or n (%).
BMI, body mass index.

TABLE 2.**Comparison of pain characteristics of patients who donated left vs right kidney**

	Left kidney donated (n = 113)	Right kidney donated (n = 34)	P
Pain	44 (38.9)	12 (35.3)	0.855
Pain side			<0.001
Both	6 (14.3)	1 (9.1)	
Left	32 (76.2)	1 (9.1)	
Right	4 (9.5)	9 (81.8)	
Pain and swelling	10 (23.8)	2 (16.7)	0.896
Pain onset			0.740
Immediately	9 (22.5)	1 (9.1)	
1–7 d	11 (27.5)	4 (36.4)	
8–14 d	8 (20.0)	3 (27.3)	
>14 d	12 (30.0)	3 (27.3)	
Pain scale 1–10	4.00 [2.00, 9.00]	4.00 [2.00, 8.00]	0.591
Max pain length, d	14.00 [1, 365]	28.00 [1, 365]	0.847
Seek additional medical professional	23 (52.3)	4 (33.3)	0.402
Had pain after seeking medical professional	14 (63.6)	1 (25.0)	0.374
If yes, pain scale 1–10	2.50 [1.50, 6.00]	6.00 [6.00, 6.00]	0.118
Donate again			0.47
Definitely yes	37 (88.1)	9 (75.0)	
Probably yes	4 (9.5)	2 (16.7)	
Not sure	1 (2.4)	1 (8.3)	
Age at donation, y	48.18 [21.97, 70.24]	48.85 [26.17, 71.90]	0.653
Height, cm	180.00 [163.00, 198.00]	178.00 [168.00, 196.00]	0.086
Weight, kg	88.45 [60.78, 112.50]	85.76 [68.04, 111.36]	0.528
BMI, kg/m ²	26.82 [21.10, 35.15]	27.70 [21.47, 35.15]	0.367

Values are mean [range] or n (%). Pain questions were only assessed on those reporting pain (n = 54).
BMI, body mass index.

TABLE 3.**Procedures/next steps in those who sought additional medical professional evaluation**

Diagnosis/procedure	n (%)
Hydrocele	7 (29)
Hydrocelectomy	2
Hydrocelectomy + denervation of spermatic cord	1
Drainage	2
No surgery	2
Nerve damage	1 (4)
Testicular cyst	2 (8)
UTI	1 (4)
Reassurance/no further procedures	13 (54)

UTI, urinary tract infection.

because they do not feel it is relevant to their donation, or they may not want to discuss a sensitive subject. In addition, if the symptom is viewed as self-limited and inconsequential, it may not be documented in the chart. However, it is notable

that the incidence of reported orchialgia was lower when the data were collected solely from chart review, compared with when the LDs were surveyed or directly questioned (Table 4).

In our study, the pain started at an average of 8 to 14 d and lasted for a mean of 14 d (range, 1–365 d). Pain was equally reported regardless of the side of the procedure: left, 38%; right, 35%. Of those with pain, 48% needed additional medical professional intervention.

The pathophysiology of postdonation orchialgia is unclear. The most common theory is that it is due to GV ligation causing decreased venous drainage and possible venous congestion. In support of this theory, Burgos et al found a significant reduction in testicular blood flow and function when performing LDN in pigs.¹² It has been suggested that ligation of the GV above the iliac vessels bifurcation could decrease the incidence of orchialgia by increasing drainage of the GV through retroperitoneal collateral branches.^{8–10} In a small study, Sureka et al randomized 40 LDs to ligation of the GV above or below iliac vessels bifurcation.¹⁰ Ipsilateral orchialgia was reported in 1% of LDs that had ligation of the GV and ureter above

TABLE 4.**Previous publications on orchialgia in men after LN**

Author	N	Data collection	Finding
Su et al ³	381	Chart review	1% reported ipsilateral orchialgia
Brook et al ⁴	31	Chart review	6.45% reported ipsilateral orchialgia
Gjertson et al ⁵	64	Directly questioned	21% reported ipsilateral orchialgia, most common on left side vs right (25% and 17%), that lasted for 34 d
Kim et al ⁶	145	Chart review	9.6% reported ipsilateral orchialgia, with average onset at postoperative day 5
Shirodkar et al ⁷	129	Identified via chart review then called for direct questions	6.2% reported ipsilateral orchialgia
Srivastava et al ⁸	440	Directly questioned	8% reported ipsilateral orchialgia, most common on left side vs right (10.2 and 5.5 %), that on average started on day 3.5 and lasted on average 15 d
Jalali et al ⁹	25	Directly questioned	44% reported ipsilateral orchialgia, 40% had testicular swelling, and average onset was immediate and lasted on average 8 d
Sureka et al ¹⁰	70	Directly questioned	1% reported ipsilateral orchialgia that had ligation of the GV and ureter above the level of the crossing of iliac vessels; 30% had orchialgia with ligation below.
Pinar et al ¹¹	69	Directly questioned	31.9% reported ipsilateral orchialgia, and 15.9% reported testicular swelling; orchialgia led to medical consultation in 41.7% cases

GV, gonadal vein.

the level of the crossing of iliac vessels. In contrast, 30% of those having ligation below iliac vessels bifurcation developed ipsilateral orchialgia.

Alternatively, orchialgia may be due to irritation, disruption, or inflammation of the pelvic nerves, such as the ilioinguinal nerve and the genital branch of the genitofemoral nerve. The neural pathways to the scrotum come from L1-L2 and S2-S4. This likely explains why some patients with ureteral stones or low back pain report with testicular pain.¹³ The sensory fibers for the upper portion of the ureter come from T11 and T12, which shares neural pathways at the same level as sensory fibers for the testes. It is feasible that dissection of the upper ureter is enough to inflame the sensory nerves to the testicles and cause perceived or referred pain. Positioning of the patient in the lateral decubitus jack-knife position could also cause irritation of these nerve roots at the level of the spine and be perceived as testicular pain. Notably, after the completion of our survey, a male LD having had right LDN without ligation of the GV reported significant right-sided orchialgia.

We found that being taller was a significant risk factor for postdonation orchialgia. There is no pathophysiologic explanation for this observation. Given that the difference in height between the 2 groups was 4 cm, this is likely clinically inconsequential.

Twenty-seven symptomatic patients sought additional medical care for their postdonation testicular symptoms. Seven had hydrocele associated with orchialgia for whom no specific etiology was determined. Given the temporal relationship of the hydrocele development to the donation, one could postulate that GV ligation resulting in increased venous pressure and disruption of venous drainage could be responsible or at least have contributed to these 7 cases of hydrocele.

Interestingly, 5 patients (3%) reported contralateral orchialgia and 7 others (5%) bilateral orchialgia. One with contralateral orchialgia reported a “lump,” diagnosed by ultrasound, on the contralateral testicle; one with bilateral orchialgia had a urinary tract infection. The pathophysiology in the remaining cases is unclear but might be referred pain, as described above, from shared neural pathways. Possibly, some had pain on one side of the testicle but perceived it as bilateral. Alternatively, at the time of the survey, many LDs were as long as 10 y postdonation and may have forgotten which side the pain occurred.

Supporting this explanation, some of our responders could not recall which kidney was donated.

Importantly, 93% of the 56 patients with orchialgia said that, if given the decision again, they would definitely or probably donate again. Only 2 reported they were “not sure.” None said they would probably not or definitely not donate again.

Orchialgia is a potential known complication of inguinal hernia repair, but this is likely a different etiology because the incisions and dissection planes are very different. It is unlikely that the hernia literature can be extrapolated to the living donor population, but perhaps the literature from posthernia orchialgia can be used to understand potential etiologies. The incidence and etiology of testicular pain after hernia repair are also poorly understood. Elucidating and understanding the incidence of orchialgia are more important in the donor population because this is a population that does not need an operation and gains no benefits (medically or physically) from this intervention.

From a diagnosis and therapeutic standpoint, orchialgia that is more severe than expected or long standing requires a thorough history and physical exam to rule out of treatable causes not related to LD before assuming it is a postnephrectomy side effect. Temporal relation to surgery makes other more worrisome causes of orchialgia less likely, but these should be ruled out. The differential is broad and includes (most commonly) postnephrectomy pain, urinary tract infection, epididymitis, testicular torsion, tumors, obstruction, varicocele, epididymal cysts, hydrocele, cystitis, aortic or common iliac aneurysms, low back disorders (which may have been exacerbated by nephrectomy positioning), indirect inguinal hernia, ureteral stones, and so on. Most common diagnostics to rule out treatable causes for pain include testicular ultrasound and urinalysis.¹⁴

The most common treatment for orchialgia is conservative observation and treatments, such as heat, ice, scrotal elevation, antibiotics if infections are found, and medications for chronic pain, such as antidepressants, anticonvulsants, and alpha-adrenergic antagonists. Physical therapy for pelvic floor weakness, biofeedback, acupuncture, and psychotherapy have also been utilized. Treatment of chronic orchialgia is challenging when patients fail conservative approaches. These patients should be referred to urology for further workup

and therapies. Treatments for chronic orchialgia can include a large variety of modalities, some of which are noninvasive and some of which are highly invasive for the more severe cases. These include varicocelectomy/hydrocelectomy (if present), microsurgical denervation of the spermatic cord, epididymectomy, microcryoablation of the perispermatic cord, botox injections, amiofix injection, regional and local nerve blocks, and finally orchietomy as a last resort.¹⁵

In review of the literature, there are several clinical management changes that may help decrease the incidence of postdonation orchialgia based on the postulated etiologies as discussed above. First and foremost, we can place more emphasis on informing the male donor preoperatively about testicular symptoms and directly ask our donors if they are having these symptoms so we may guide them through the conservative management modalities detailed above and improve patient satisfaction and recovery time. From a surgical perspective, surgeons may opt to leave the GV in place on the right and leave as much of the GV in place on the left as possible to allow for retroperitoneal collaterals as drainage for the testicle. In addition, more attention can be directed to not violate the fascia over the psoas, be mindful of how low in the pelvis the ureter is dissected, and be mindful of the amount of tissue dissected with the ureter.

There are limitations of this study. First, this was a retrospective data collection including chart review and mail survey. For this reason, the data may be viewed as largely descriptive, but chart review studies may underestimate incidence. Second, 46% of surveyed LDs responded; responses may differ between those that responded to the survey and those that did not. It is plausible to consider that we may have a different incidence with a better response rate. Third, given that the LDs were surveyed 1–10 y after surgery, it is possible that some of the data provided were inaccurate and that recall bias was introduced. The laterality of the pain, intensity of the pain, and duration of the pain could all be altered, especially in patients who had a long period of time between donation and the survey. The etiology of the pain can also be from different sources, and it is often difficult for men to discern true orchialgia from discomfort in the inguinal/scrotal area. It is possible that some responses to the survey that reported pain in the testicle were perhaps pain in the scrotum or inguinal area as opposed to true orchialgia.

Our results suggest orchialgia is an underappreciated complication following LDN. Male LD candidates should be counseled about this risk and incidence at the time of consent. Bringing about awareness will make it more likely for donors

to discuss these symptoms with their surgeon in the postoperative visit. Attentiveness to the true incidence of testicular pain postdonation may allow institutions to formulate a decision tree guideline for male donors on when to seek additional medical attention. Finally, revealing the true incidence of this side effect will hopefully lead to studies to evaluate the pathophysiology of this donation-related complication.

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