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ORIGINAL ARTICLE

Male Health

Do I need to see a urologist for my vasectomy? A comparison of practice patterns between urologists and family medicine physicians

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Urologists perform the majority of vasectomies in the United States; however, family medicine physicians (FMPs) perform up to 35%. We hypothesized that differences exist in practice patterns and outcomes between urologists and FMPs. Patients who underwent a vasectomy from 2010 to 2016 were identified. Postvasectomy semen analysis (PVSA) practices were compared between urologists and FMPs, before and after release of the 2012 AUA vasectomy guidelines. From 2010 to 2016, FMPs performed 1435 (35.1%) of all vasectomies. PVSA follow-up rates were similar between the two groups (63.4% vs 64.8%, $P = 0.18$). Of the patients with follow-up, the median number of PVSAs obtained was 1 (range 1–6) in both groups ($P = 0.22$). Following the release of guidelines, fewer urologists obtained multiple PVSAs (69.8% vs 28.9% pre- and post-2012, $P < 0.01$). FMPs had a significant but lesser change in the use of multiple PVSAs (47.5% vs 38.4%, $P < 0.01$). Both groups made appropriate changes in the timing of the first PVSA, but FMPs continued to obtain PVSAs before 8 weeks (15.0% vs 6.5%, $P < 0.01$). FMPs had a higher rate of positive results in PVSAs obtained after 8 weeks, the earliest recommended by the AUA guidelines (4.1% vs 1.3%, $P < 0.01$). Significant differences in PVSA utilization between FMPs and urologists were identified and were impacted by the release of AUA guidelines in 2012. In summary, FMPs obtained multiple PVSAs more frequently and continued to obtain PVSAs prior to the 8-week recommendation, suggesting less penetration of AUA guidelines to nonurology specialties. Furthermore, FMPs had more positive results on PVSAs obtained within the recommended window.

Asian Journal of Andrology (2019) 21, 540–543; doi: 10.4103/aja.aja_13_19; published online: 30 April 2019

Keywords: evidence-based practice; family practice; semen analysis; urologist; vasectomy

INTRODUCTION

Urologists perform the majority of vasectomies in the United States; however, in some regions of the country, up to 35% are performed by family medicine physicians (FMPs) or general surgeons.¹ In 2012, the American Urological Association (AUA) released guidelines to aid clinicians in implementing evidence-based practices in vasectomy care, including a post-vasectomy semen analysis (PVSA) protocol. PVSA is an important tool in confirming the effectiveness of a vasectomy and counseling patients as to the reliability of their procedure as a contraceptive method. The goals of the protocol recommended by the AUA were to simplify postvasectomy practices, increase patient compliance, and optimize the timing so as to confirm occlusive effectiveness at the soonest possible time while minimizing the number of PVSAs needed.² Studies of both civilian and military urologic practices have shown that the AUA guidelines have been successful in improving compliance, avoiding unnecessary PVSAs, and reducing repeat vasectomies.^{3,4} Although these guidelines are available to all physicians, their implementation in nonurologic practices has not been studied.

We previously reported the results of a single-institutional survey of urologists and nonurologists (FMPs) on their vasectomy

and postvasectomy practices. There was significant heterogeneity in self-reported PVSA practice patterns. Self-reportedly, FMPs were more likely to send a PVSA earlier than urologists, send multiple PVSAs, and answer discordantly from guideline recommendations in clinical scenario questions.⁵ The goal of this study was to objectively evaluate PVSA practice patterns in urologists and FMPs, before and after the implementation of the 2012 AUA vasectomy guidelines.

PATIENTS AND METHODS

A retrospective review of billing codes was conducted to identify all patients who underwent a vasectomy at the University of Wisconsin Health System, Madison, Wisconsin, USA, from 2010 to 2016. All vasectomies performed by urologists or FMPs in this time period were included. The study was approved by the Institutional Review Board (University of Wisconsin School of Medicine and Public Health, USA) for human subjects and did not require additional consent due to its retrospective nature.

Records were reviewed for vasectomy date, physician-performed procedure, number and timing of PVSAs obtained, as well as their results. PVSA follow-up was considered as obtaining at least one PVSA following vasectomy. Time to first PVSA was calculated as the difference between vasectomy date and date of the first PVSA.

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Received: 16 July 2018; Accepted: 18 December 2018

Positive PVSA was defined as the presence of motile sperm on a fresh, uncentrifuged semen sample. In accordance with the AUA guidelines,² a negative PVSA, which allows for patients to stop using other methods of contraception, was defined as azoospermia or only rare nonmotile sperm (RNMS or $\leq 100\,000$ nonmotile sperm per ml) on a well-mixed and uncentrifuged sample within 2 h of collection.

Data were stratified by the specialty of performing practitioner, either urologist or FMP. Procedures were also separated into those occurring before the release of the 2012 AUA guidelines and those occurring after.

Comparisons in PVSA practice patterns were made between the two specialties. Change in practice patterns before and after 2012 was also evaluated. Descriptive statistics looked at both means and medians to not allow outliers to confound the results. Statistical analysis was conducted using Mann–Whitney U and Chi-squared tests for continuous and categorical variables, respectively. At our institution, there are no departmental protocols in place for PVSA testing for either urologists or FMPs.

RESULTS

Review of billing codes identified 4094 patients who underwent vasectomy procedures at the University of Wisconsin Health System from 2010 to 2016. Urologists performed 2659 (64.9%) vasectomies, whereas FMPs performed 1435 (35.1%). Patient demographics are shown in **Table 1**.

The majority of vasectomies performed by urologists were done by three physicians with a range of 674–717 total procedures performed over the course of the 7 years studied. In contrast, the three most experienced FMPs performed between 101 and 158 procedures over the study period. Thirty-two patients had a vasectomy performed by a FMP who performed only a single vasectomy over the study period.

A total of 1776 vasectomies were performed from 2010 to 2012, with urologists accounting for a greater percentage of vasectomies compared to FMPs (59.8% vs 40.2%, respectively). From 2013 to 2016, 2318 vasectomies were performed. The proportion performed by urologists further increased compared to FMPs (68.9% vs 31.1%, respectively).

We hypothesized that there may be differences in PVSA follow-up rates if done by FMP who is likely the primary care doctor for the patient. We found that PVSA follow-up rates were similar between the two groups, 1686 (63.4%) of urologists and 931 (64.9%) of FMPs obtained at least one PVSA, $P = 0.18$ (**Table 1**). Interestingly, after 2012, urologists' follow-up rate decreased from 67.0% to 61.0%, $P < 0.01$. FMPs, on the other hand, had a significant rise in follow-up rates from 62.2% to 67.5%, $P = 0.04$ (**Table 2**).

Of the patients who obtained at least one PVSA, the median number of PVSAs obtained between 2010 and 2016 was 1 (IQR 1–2) for urologists and 1 (IQR 1–2) for FMPs ($P = 0.22$) (**Table 1**). Before 2012, urologists obtained a median of 2 (IQR 1–2) PVSAs, whereas after 2012, they obtained 1 (IQR 1–2), $P < 0.01$. The mean (\pm standard deviation) number of PVSAs showed a significant decline from 1.84 ± 0.72 to 1.31 ± 0.52 , $P < 0.01$. FMPs' median number of PVSA was 1 (IQR 1–2) both before and after 2012, $P < 0.01$. There was a slight decrease in the average (\pm standard deviation) number of PVSAs performed by FMPs before and after 2012 from 1.59 ± 0.76 to 1.47 ± 0.69 , $P < 0.01$ (**Table 2**).

Overall, there was also no difference in practitioners obtaining multiple PVSAs, with 43.1% urologists and 42.7% FMPs obtaining more than one PVSA, $P = 0.10$ (**Table 1**). However, following the release of the guidelines, fewer urologists obtained multiple PVSAs (69.8% vs 28.9%, $P < 0.01$). This practice pattern change was seen

Table 1: Demographics and clinical variables

	Urologists	FMPs	P
Number of vasectomies	2659	1435	
Patient age (year), median (IQR)	38 (34–42)	37 (33–41)	<0.01
Follow-up rate, <i>n</i> (%)	1686/2659 (63.4)	931/1435 (64.8)	0.18
Vasectomy, <i>n</i> (%)			<0.01
Before 2012	1062/2659 (39.9)	714/1435 (49.8)	
After 2012	1597/2659 (60.1)	721/1435 (50.2)	
PVSAs obtained, <i>n</i> (%)			0.01
0	973/2659 (36.6)	504/1435 (35.1)	
1	908/2659 (34.2)	533/1435 (37.1)	
2	679/2659 (25.5)	329/1435 (22.9)	
3	78/2659 (2.9)	50/1435 (3.5)	
4	17/2659 (0.7)	13/1435 (0.9)	
5	1/2659 (0.04)	6/1435 (0.4)	
6	3/2659 (0.1)	0/1435 (0.0)	
Repeat vasectomy, <i>n</i> (%)	13/2659 (0.5)	5/1435 (0.3)	0.80
Number of PVSAs, median (IQR)	1 (1–2)	1 (1–2)	0.22
Multiple PVSAs, <i>n</i> (%) ^a	778/1686 (46.1)	398/931 (42.7)	0.10
Time to first PVSA (week), <i>n</i> (%) ^a			<0.01
<8	87/1686 (5.2)	183/931 (19.7)	
8–16	1028/1686 (61.0)	501/931 (53.8)	
>16	568/1686 (33.7)	247/931 (26.5)	
PVSA results, <i>n</i> (%) ^a			<0.01
RNMS	271/1686 (16.1)	228/931 (24.4)	
No sperm	1384/1686 (82.1)	629/931 (67.6)	
Motile sperm	31/1686 (1.8)	49/931 (5.3)	

^aIn patients who had at least one PVSA obtained postoperatively. PVSA: postvasectomy semen analysis; RNMS: rare nonmotile sperm; FMP: family medicine physicians, IQR: interquartile range

in all three of the urologists performing the majority of institutional vasectomies (**Table 3**). FMPs, however, had less of a change in their use of multiple PVSAs (47.5% vs 38.4% pre- and post-2012, $P < 0.01$) (**Table 2**). When comparing the use of multiple PVSAs after the release of the guidelines, FMPs continued to obtain multiple PVSAs at a significantly higher frequency than urologists (38.4 vs 28.9, $P < 0.01$). The greatest disparity between urologists and FMPs obtaining a second PVSA was seen in the setting of a first PVSA showing azoospermia (**Table 4**).

There was a significant difference in time to the first PVSA. The median time to the first PVSA was 14 weeks (IQR 12.6–18.0) for urologists and 12.6 weeks (IQR 8.7–16.7) for FMPs, $P < 0.01$ (**Table 1**). Urologists decreased their time to first PVSA after introduction of the guidelines. The median for urologists before 2012 was 14.7 weeks (IQR 13.0–19.0) and 13.8 weeks (IQR 11.7–17.7) after 2012, $P < 0.01$. Conversely, FMPs had an increase in time to the first PVSA from 11.4 weeks (IQR 8.0–16.7) to 13 weeks (9.0–16.7), $P = 0.02$. Following the release of the 2012 guidelines, urologists had an increase in PVSAs obtained before 8 weeks (3.4% vs 6.5%, $P < 0.01$). FMPs obtained fewer PVSAs before 8 weeks after 2012 (24.8% vs 15.0%, $P < 0.01$) (**Table 2**). Although FMPs changed their practice patterns appropriately, the rate of early PVSAs obtained by FMPs was still significantly higher than that obtained by urologists (15.0% vs 6.5%, $P < 0.01$).

FMPs had a higher rate of positive results, defined as motile sperm at time of the first PVSA, with 5.3% of initial PVSAs being positive for FMPs and 1.8% for urologists, $P < 0.01$. Interestingly, when stratified based on the timing of obtaining PVSA, there was no difference in positive results before 8 weeks, with 11 (12.6%) urologists and 18 (10.2%) FMPs finding motile sperm on the PVSA, $P = 0.54$.

Table 2: Change in postvasectomy semen analysis patterns before and after the release of 2012 guidelines

	Urologists		P	FMPs		P
	Before 2012	After 2012		Before 2012	After 2012	
Vasectomy (n)	1062	1597		714	721	
Follow-up rate, n (%)	712/1062 (67.0)	974/1597 (61.0)	<0.01	444/714 (62.2)	487/721 (67.5)	0.04
PVSAs obtained (n), median (IQR)	2 (1–2)	1 (1–2)	<0.01	1 (1–2)	1 (1–2)	<0.01
Multiple PVSAs, n (%)	497/712 (69.8)	281/974 (28.9)	<0.01	211/444 (47.5)	187/487 (38.4)	<0.01
Time to 1 st PVSA (week), median (IQR)	14.7 (13.0–19.0)	13.8 (11.7–17.7)	<0.01	11.4 (8.0–16.7)	13.0 (9.0–16.7)	0.02
PVSAs obtained before 8 weeks, n (%)	24/712 (3.4)	63/974 (6.5)	<0.01	110/444 (24.8)	73/487 (15.0)	<0.01

PVSA: postvasectomy semen analysis; FMP: family medicine physicians; IQR: interquartile range

When comparing PVSAs obtained after 8 weeks, as recommended by the AUA, urologists had significantly lower rates of positive results, with only 20 (1.3%) findings of motile sperm compared to 30 (4.1%) of FMPs, $P < 0.01$ (Table 5). Urologists performed repeat vasectomies in 0.5% (13/2659) of patients. FMPs performed repeat vasectomies in 0.3% (5/1435) of patients although this number may have been higher as patients may have been referred to urologists for their repeat procedure, $P = 0.80$ (Table 1).

DISCUSSION

Vasectomy is a common contraceptive procedure, which is often performed by nonurologists, with up to one-third of all vasectomies in the United States being performed by FMPs or general surgeons.¹ In 2012, the AUA released guidelines regarding various aspects of vasectomy care including the timing for obtaining PVSAs and their interpretation. These guidelines have been shown to improve compliance, decrease the use of multiple PVSAs, and reduce the number of repeat vasectomies in civilian and military urologic practices.^{3,4,6,7} The implementation and use of these guidelines by nonurologists (FMPs) has not previously been studied. Furthermore, the dissemination and effects of professional society specific guidelines released by the AUA to nonurologists were of interest to us. We found that there were significant differences in practice patterns and adherence to the 2012 AUA guidelines between urologists and FMPs.

Despite the importance of a PVSA in determining vasectomy success, a significant proportion of patients fail to obtain a PVSA. In a recent multi-institutional study, it was found that 47.9% of men did not submit a semen sample despite numerous reminders.⁸ Our data demonstrate a similarly low follow-up rate of approximately 60%, which was comparable in both the FMP and urology cohort. This is similar to other studies which have cited rates of 48%–66%.^{3,6,8,9} Factors including younger age, larger number of children, and lower education level predict decreased compliance with PVSA.^{8,10} It is important that both urologists and FMPs continue working on better pre- and post-vasectomy counseling to increase compliance rates.

The optimal timing of PVSA has historically been a topic of debate. Sharlip *et al.*² conducted a literature review of 11 studies at 8 weeks postvasectomy and found that six reported an azoospermia rate of 80% or higher; thus, the AUA guidelines recommend 8–16 weeks as the appropriate time range for obtaining a PVSA.² We found that median time to PVSA, before and after 2012, for both urologists and FMPs was in this range. After the release of guidelines, both urologists and FMPs remained within the recommended time interval for obtaining a PVSA. A previous survey of our institutional practice patterns found that most FMPs self-reported performing the first PVSA between 8 and 9 weeks, and 22% reported obtaining a PVSA earlier, at 4–7 weeks after vasectomy. An overwhelming majority of urologists reported

Table 3: Practice patterns for the three urologists performing the majority of institutional vasectomies

Urologists	1	2	3
Multiple PVSAs, n (%)			
Before 2012	148 (62.7)	160 (78.0)	131 (78.9)
After 2012	73 (33.8)	67 (24.2)	68 (28.0)

PVSA: postvasectomy semen analysis

Table 4: Comparison of the second postvasectomy semen analysis obtained based on the results of first postvasectomy semen analysis for urologists and family medicine physicians after 2012

Results of first PVSA	Number of second PVSA obtained		P
	Urologists	FMPs	
Azoospermic, n (%)	141 (17.9)	82 (24.8)	0.01
RNMS, n (%)	118 (70.7)	79 (69.3)	0.69
Motile sperm, n (%)	20 (95.2)	21 (80.8)	0.20

PVSA: postvasectomy semen analysis; RNMS: rare nonmotile sperm; FMP: family medicine physicians

Table 5: Comparison of positive postvasectomy semen analysis results based on the timing of obtaining postvasectomy semen sample

Timing of PVSA	Urologists	FMPs	P
<8 weeks			0.54
Azoospermic or RNMS, n (%)	76/87 (87.4)	159/177 (89.8)	
Motile sperm, n (%)	11/87 (12.6)	18/177 (10.2)	
≥8 weeks			<0.01
Azoospermic or RNMS, n (%)	1575/1595 (98.7)	696/726 (95.9)	
Motile sperm, n (%)	20/1595 (1.3)	30/726 (4.1)	

PVSA: postvasectomy semen analysis; RNMS: rare nonmotile sperm; FMP: family medicine physicians

obtaining the first PVSA at 10–12 weeks.⁵ It is notable that, after the release of the guidelines, the percentage of PVSAs obtained by FMPs before 8 weeks decreased from 24.8% to 15.0%, possibly suggesting the implementation of the recommendations. Even so, nonurologists' percentage of early PVSAs, before 8 weeks, was still much higher than that of urologists. Although we noted a trend toward waiting the appropriate time to obtain PVSA testing, many FMPs continue to obtain PVSAs early, increasing the likelihood of a false-positive result and need for repeat testing. This may unnecessarily increase global vasectomy cost and patient anxiety.

A significant amendment of the 2012 AUA guidelines considered rare nonmotile sperm (RNMS) an occlusive success. This decision was based on studies showing that the risk of pregnancy was similar when comparing azoospermia and RNMS.² This amendment resulted in higher rates of occlusive success at the first PVSA, from 69% to 94% in a study of 1623 active service members. The same study

showed that foregoing a second PVSA in men with RNMS resulted in significant cost saving by reducing unneeded testing and unnecessary repeat vasectomies.⁴ Furthermore, compliance with testing decreases with subsequent PVSAs.³ We found that, following the release of the guidelines, urologists decreased their use of multiple PVSAs by over 40%. Conversely, FMPs only decreased multiple PVSA testing by 9.1%, suggesting a lack of implementation or adherence to the AUA guidelines, which may speak to the reach of specialty-specific guidelines. Given that FMPs are more likely to obtain PVSA <8 weeks after vasectomy, this may lead to false-positive results and further PVSA testing. FMPs may also be incorrectly interpreting PVSAs. A study by Shapiro *et al.*⁵ recently found that, when surveyed, 87% of FMPs would repeat a PVSA on a patient with RNMS despite guidelines recommending against it. However, in our cohort, the practice pattern differences in the use of multiple PVSAs following the release of the AUA guidelines were driven primarily by second PVSAs obtained after finding azoospermia.

A surprising finding of our study was that FMPs had higher rates of positive results. We hypothesized that this may be related to earlier testing because a shorter time period before the first PVSA has been shown to result in decreased rates of azoospermia or RNMS.² In order to clarify this, we stratified PVSAs based on whether they were obtained within the time range recommended by the AUA. Unsurprisingly, PVSAs obtained before 8 weeks had higher rates of positive results, with similar rates of motile sperm for both urologists and FMPs. We can assume that most of these patients had not achieved sperm clearance at the time of the PVSA. The PVSA timing recommendation made by the AUA guidelines is based on studies which have shown that, although RNMS rates continue to decrease and azoospermia rates increase after 8 weeks, the frequency of motile sperm does not change, indicating that these likely represent vasectomy failure.¹¹ Interestingly, when comparing only PVSAs obtained after 8 weeks, we found that FMPs continued to have significantly higher rates of motile sperm than urologists (4.1% vs 1.3%). The reason for the higher rate of vasectomy failure is unknown but may be related to experience level or technique. Survey results at our institution previously showed that FMPs had higher variation in vasectomy technique.⁵ We did not have data on technique used in our study, and the literature does not overwhelmingly favor a specific technique,¹² but it is conceivable that variation in operative practice may have contributed to increased failure rate. Our study is also limited as we did not have pregnancy rates which would be a determinant of true vasectomy failure.

At our institution, urologists had substantially more experience, with the top urologists performing over four times as many vasectomies as the high-volume FMPs. Urologists are more familiar with the anatomy and have the ability to perform scrotal explorations in the event of a complication. Nevertheless, there is evidence that vasectomy failure rates are similar between urologists and nonurologists.¹³ In some areas where urology access is limited, FMPs may be more likely to perform vasectomies; thus, it is important that FMPs continue to perform vasectomies while basing their practice patterns on evidence-based recommendations. Based on the results of the present study, further exposure to AUA guidelines may reduce the practice heterogeneity between FMPs and urologists.

The primary limitation of our study was that, given its retrospective nature, we had no ability to control for patient compliance or adherence to physician recommendations. Nevertheless, we believe that there would be minimal variation in this factor between patients seen by urologists or FMPs. A second limitation is lack of pregnancy data

following vasectomy, which would allow us to observe the impact of PVSA practice patterns on contraceptive efficacy. Finally, we did not have information regarding individual physician exposure to the guideline statements; thus, we do not know if physicians are poorly compliant and simply unaware of guideline statements or if there is a third factor such as modification of insurance company policies that is driving the change in practice patterns.

CONCLUSION

Significant postvasectomy practice pattern differences exist between urologists and FMPs, and these differences persisted after the release of the AUA vasectomy guidelines of 2012. Specifically, FMPs obtained multiple PVSAs more frequently and continued to obtain PVSAs prior to the 8-week recommendation. It is important that both urologists and nonurologists continue to work on integrating optimal evidence-based care into their postvasectomy patient recommendations in order to decrease unnecessary testing, repeat procedures, and global vasectomy cost.

AUTHOR CONTRIBUTIONS

NMP carried out data synthesis and analysis, as well as drafted the manuscript. DDS assisted with the data synthesis and analysis and edited the manuscript. XW assisted with statistical analysis. BVL conceived of the study and participated in its design and helped to draft the manuscript. All authors read and approved the final manuscript.

COMPETING INTERESTS

All authors declare no competing interests.

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