doi: 10.13241/j.cnki.pmb.2018.20.038

SHA.LIN 评分和 S.T.O.N.E 评分对经皮肾镜取石术结石清除率的预测价值比较 *

陈志强 于 淼 隋振宇 刘有智 徐 蔚

（解放军第 230 医院泌尿外科 辽宁 丹东 118000）

摘要 目的:比较 SHA.LIN 评分和 S.T.O.N.E 评分对经皮肾镜取石术结石清除率的预测价值。**方法:**选择我院于 2016 年 1 月 -2017 年 12 月期间行经皮肾镜取石术患者 67 例为研究对象,在术前对所有患者进行 SHA.LIN 评分和 S.T.O.N.E 评分。根据手术结果将患者分为结石清除组(n=49)和结石残留组(n=18),对两组患者的一般资料、SHA.LIN 评分、S.T.O.N.E 评分进行统计对比。采用多因素 Logistic 回归分析方法分析患者术后结石残留的影响因素。采用绘制 ROC 曲线的方法分析 SHA.LIN 评分和 S.T.O.N.E 评分对结石清除率的预测结果的敏感性和特异性。**结果:**67 例患者术后结石清除者 49 例、结石残留者 18 例，结石清除率为 73.13%。结石残留组患者手术时间、术中失血量、住院时间、结石最大截面积、最大累积截面积、结石解剖分布肾盂的发生率、受累肾盏数均高于结石清除组,穿刺通道长度低于结石清除组（*P<0.05*）。结石清除组患者的 SHA.LIN 评分、S.T.O.N.E 评分均低于结石残留组(*P<0.05*)。经多因素 Logistic 回归分析显示,手术时间、术中失血量、SHA.LIN 评分、S.T.O.N.E 评分、受累肾盏数是结石残留的影响因素(*P<0.05*)。通过绘制 ROC 曲线可知,SHA.LIN 评分的敏感性为 91.25%、特异性为 89.12%、曲线下面积(AUC)为 0.912(95%CI 0.869~0.948);S.T.O.N.E 评分的敏感性为 78.75%、特异性为 84.24%、AUC 为 0.782(95%CI 0.690~0.871)。**结论:**经皮肾镜取石术患者结石清除率与 SHA.LIN 评分、S.T.O.N.E 评分明显相关,两种评分系统均能预测患者的结石清除率,但 SHA.LIN 评分的敏感性、特异性高于 S.T.O.N.E 评分。

关键词:经皮肾镜取石术;结石清除率;SHA.LIN 评分;S.T.O.N.E 评分;预测价值

中图分类号:R692.4 **文献标识码:**A **文章编号:**1673-6273(2018)20-3967-05

Comparison of the Predictive Value of SHA.LIN Scores and S.T.O.N.E Scores on the Stone Removal Rate of Percutaneous Nephrolithotomy*

CHEN Zhi-qiang, YU Miao, SUI Zhen-yu, LIU You-zhi, XU Wei

(Department of Urology Surgery, The 230th Hospital of PLA, Dandong, Liaoning, 118000, China)

ABSTRACT Objective: To observe and compare the predictive value of SHA.LIN and S.T.O.N.E scores on the stone removal rate of percutaneous nephrolithotomy. **Methods:** 67 cases of percutaneous neurolithotomy who were treated in our hospital from January 2016 to December 2017 were selected as the research subjects, and all the patients were scored by SHA.LIN scores and S.T.O.N.E scores before operative. The patients were divided into stone clearance group (n=49) and stone residual group (n=18) according to the surgical results. The general data, SHA.LIN scores and S.T.O.N.E scores of two groups of patients were statistically compared. The influencing factors of postoperative residual stones in patients was analyzed by Multiple factor regression analysis of Logistic. The ROC curve was used to compare the sensitivity and specificity of SHA.LIN scores and S.T.O.N.E scores to the prediction of stone clearance. **Results:** There were 49 cases of stone clearance and 18 cases of stone residual in 67 patients, and the stone clearance rate was 73.13%. The operation time, blood loss, hospitalization time, the largest stone cross-sectional area, the maximum cumulative cross-sectional area, the incidence of renal pelvis calculi anatomic distribution, involvement of renal calices in the stone residual group were higher than that of the stone clearance group, puncture channel length was less than that of the stone clearance group (*P<0.05*). The SHA.LIN scores and S.T.O.N.E scores of the patients in the stone clearance group were lower than those of the stone residual group (*P<0.05*). Multiple factor regression analysis of Logistic showed that operation time, blood loss, SHA.LIN scores, S.T.O.N.E scores and affected renal calyx number were the influencing factors of residual stone (*P<0.05*). By drawing the ROC curve, the sensitivity of the SHA.LIN scores was 91.25%, the specificity was 89.12%, and the area under the curve (AUC) was 0.912 (95% CI 0.869~0.948). The sensitivity of S.T.O.N.E scores was 78.75%, the specificity was 84.24%, and AUC were 0.782 (95%CI 0.690~0.871). **Conclusion:** Percutaneous nephrolithotomy is obviously related to stone clearance rate, SHA.LIN scores and S.T.O.N.E scores, two scoring systems can predict with the stone clearance rate,but the sensitivity and specificity of SHA.LIN scores is higher than that of S.T.O.N.E scores.

Key words: Percutaneous nephrolithotomy; Stone clearance rate; SHA.LIN scores; S.T.O.N.E scores; Predictive value

---

* 基金项目:辽宁省科技攻关计划项目(2011224063)

作者简介:陈志强(1976-),男,本科,主治医师,研究方向:泌尿外科相关疾病方面的研究,E-mail: kphfhd@163.com

(收稿日期:2018-04-16 接受日期:2018-05-12)

Chinese Library Classification(CLC): R692.4 Document code: A
Article ID: 1673-6273(2018)20-3967-05

结石是由有机基质如钙、草酸、尿酸、酸性黏多糖等物质在肾脏大量集聚形成的块状、颗粒状晶体物质，肾结石是泌尿系统的常见病、多发病，其给患者造成难以忍受的疼痛感，严重影响患者的生活质量[1-3]。经皮肾镜取石术是治疗肾结石较为有效的方法，但是在手术进行过程中，由于患者自身因素、手术进展情况以及其他突发情况的影响，造成部分患者在术后出现结石残留的可能[4,5]。因此，对于经皮肾镜取石术患者，若能采用一种可靠准确的术前评估肾结石复杂程度并对患者术后结石残留情况进行预测的评分系统，将有助于患者病情的评估和手术方案的设计，以期获得更好的预后[6,7]。目前对肾结石评估的评分系统主要有 S.T.O.N.E 评分[8]、S-ReSC 评分[9]、Guy's 评分[10]等，其可通过影像学检查来判断患者肾结石的复杂程度以及预测术后结石清除率。SHA.LIN 评分是一种新型的肾结石评分系统，通过对患者 CT 影像资料的全方位观察，获得多个量化指标，从而对结石清除率具有一定的预测价值[11,12]。为此，本研究对我院行经皮肾镜取石术患者在术前分别进行 SHA.LIN 评分、S.T.O.N.E 评分，探讨两种评分系统对结石清除率的预测价值，现报道如下。

1 资料与方法

1.1 研究对象

选择我院 2016 年 1 月 -2017 年 12 月期间行经皮肾镜取石术患者 67 例为研究对象，其中男性 38 例、女性 29 例，患者年龄 28-59 岁，平均(44.28± 10.92)岁。纳入标准[13]：(1)患者经 X 射线、超声、CT 检查确诊为肾结石；(2) 患者术前均进行 SHA.LIN 评分、S.T.O.N.E 评分；(3) 患者均完成经皮肾镜取石术；(4)患者签署知情同意书。排除标准：(1)精神障碍患者，妊娠哺乳期妇女等特殊人群；(2)术前影像资料不全者；(3)合并其他泌尿系统疾病者。根据手术结果将患者分为结石清除组(n=49)和结石残留组(n=18)，两组患者性别、年龄、体质指数、美国麻醉医师协会 (American Society of Anesthesiologists, ASA)分级、结石位置、肾积水程度等一般资料比较无统计学意义($P>0.05$)，见表 3，提示均衡可比。本研究经医院伦理委员会批准通过。

1.2 研究方法

1.2.1 一般资料收集 收集患者的一般资料，包括患者的姓名、性别、年龄、体质量指数、ASA 分级、结石数量、结石位置、肾积水情况、受累肾盏数、手术时间、术中失血量、术后住院时间、结石残留情况等，并做好记录统计。

1.2.2 SHA.LIN 评分、S.T.O.N.E 评分 术前一天由同一位医师根据患者的 CT 扫描结果及三维重建影像资料对每一位患者进行 SHA.LIN 评分和 S.T.O.N.E 评分。SHA.LIN 评分标准见表 1，该表总分为 17 分；S.T.O.N.E 评分标准见表 2，该表总分为 12 分。所有患者在完成 SHA.LIN 评分、S.T.O.N.E 评分后，均进行相同的经皮肾镜取石术。

1.2.3 结石残留判断标准 患者术后 X 射线检查术侧尿路内未见高密度影或阴影直径≤ 4 mm 可认为结石清除，而阴影直径 >4 mm 则可认定为结石残留。

1.3 统计学方法

数据处理采用 SPSS 20.0 软件完成，计量资料以 ($\bar{x}\pm s$)表示，组间比较实施 t 检验，计数资料以[n(%)]表示，组间比较实施 x^2 检验，影响因素分析采用为 Logistic 为回归分析，SHA.LIN 评分、S.T.O.N.E 评分对结石清除率预测价值的敏感性、特异性采用 ROC 曲线分析，当 $P<0.05$ 时差异有统计学意义。

2 结果

2.1 两组患者一般资料比较

67 例患者术后结石清除者 49 例、结石残留者 18 例，结石清除率为 73.13%。结石残留组患者手术时间、术中失血量、住院时间、结石最大截面积、最大累积截面积、结石解剖分布肾盂的发生率、受累肾盏数均高于结石清除组，穿刺通道长度低于结石清除组 ($P<0.05$)，见表 3。

2.2 两组患者 SHA.LIN 评分和 S.T.O.N.E 评分比较

结石清除组患者的 SHA.LIN 评分、S.T.O.N.E 评分均低于结石残留组($P<0.05$)，见表 4。

2.3 影响结石残留的多因素 Logistic 回归分析

经多因素 Logistic 回归分析显示，手术时间、术中失血量、SHA.LIN 评分、S.T.O.N.E 评分、受累肾盏数是结石残留的影响因素($P<0.05$)，见表 5。

表 1 SHA.LIN 评分标准

Table 1 SHA.LIN scoring standard

Evaluation content		Score (scores)
maximum cumulative cross-sectional area(mm^2)	≤ 399	1
	400-799	2
	800-1599	3
	≥ 1600	4
Degree of hydronephrosis	No, mild	1
	Moderate	2
	Severe	3
Distribution of stone	Lower middle calyx, the renal pelvis	1
	Suprarenal calyx	2
	Partial antler type	3
	Complete antler type	4
Length of puncture channel (mm)	≤ 100	1
	>100	2
Stone density(HU)	≤ 950	1
	>950	2
Number of renal calyx involved(n)	≤ 2	1
	>2	2

表 2 S.T.O.N.E 评分标准

Table 2 S.T.O.N.E scoring standard

Evaluation content		Score (scores)
Maximum cumulative cross-sectional area(mm^2)	≤ 399	1
	400-799	2
	800-1599	3
	≥ 1600	4
Length of puncture channel(mm)	≤ 100	1
	>100	2
Degree of hydronephrosis	No, mild	1
	Moderate、severe	2
Number of renal calyx involved(n)	≤ 2	1
	>2	2
Stone density(HU)	≤ 950	1
	>950	2

表 3 两组患者一般资料比较

Table 3 Comparison of general data in two groups of patients

Gteneral data		Stone clearance group (n=49)	Stone residual group (n=18)	t/x^2	*P*
Gender	Male	28	10	0.113	0.907
	Female	21	8		
Age (years)		43.98± 10.87	45.36± 11.90	0.449	0.655
Body mass index(kg/m^2)		24.12± 2.39	25.19± 3.11	1.495	0.140
ASA	Class I	23	8	0.149	0.975
	Class II	15	6		
	Class III	11	4		
Stone position	Left kidney	29	11	0.120	0.887
	Right kidney	20	7		
Degree of hydronephrosis	No	21	8	1.028	0.905
	Mild	13	6		
	Moderate	10	3		
	Severe	5	1		
Operation time(min)		71.92± 15.28	96.37± 19.03	5.428	0.000
Blood loss(mL)		87.23± 20.35	117.04± 33.48	4.419	0.000
Hospitalization time (d)		7.01± 1.98	8.96± 2.35	3.396	0.001
Maximum cumulative cross-sectional area(mm^2)		309.78± 123.07	521.86± 186.32	5.405	0.000
Length of puncture channel(mm)		112.96± 12.39	94.36± 11.23	5.579	0.000
Maximum cumulative sectional area(mm^2)		452.38± 167.54	798.90± 230.75	6.754	0.000
Anatomic distribution of stones	Renal pelvis	35	3	21.430	0.000
	Calyx	10	5		
	Renal parenchyma	4	10		
Number of renal calyx involved(n)		1.72± 0.76	3.38± 1.14	6.880	0.000

表 4 两组患者 SHA.LIN 评分和 S.T.O.N.E 评分比较(分，$\bar{x}\pm s$)

Table 4 Comparison of SHA.LIN and S.T.O.N.E scores in the two group (scores, $\bar{x}\pm s$)

Groups	n	SHA.LIN	S.T.O.N.E
Stone clearance group	49	8.01± 1.09	6.95± 0.98
Stone residual group	18	10.89± 1.27	8.16± 1.15
t	-	9.168	4.274
P	-	0.000	0.000

表 5 影响结石残留的多因素 Logistic 回归分析

Table 5 Multiple factor regression analysis of Logistic affecting residual stones

Variable	β	Wald x^2	*P*	OR	95%CI
Operation time	1.300	6.358	0.019	1.092	0.984~1.275
Blood loss	1.457	6.793	0.011	1.049	1.011~1.056
Hospitalization time	0.672	0.719	0.223	0.972	0.778~1.296
Maximum section area of stone	0.741	0.838	0.164	1.067	0.892~1.451
Length of puncture channel	0.614	0.914	0.246	1.074	1.061~1.093
Maximum cumulative sectional area	0.762	0.865	0.198	1.111	0.823~1.471
Anatomic distribution of stones	0.756	0.842	0.178	1.002	0.984~1.275
Number of renal calyx involved	1.489	7.561	0.010	1.092	0.984~1.275
SHA.LIN	1.562	8.032	0.000	2.071	1.761~2.342
S.T.O.N.E	1.513	7.934	0.007	1.831	1.679~2.234

2.4 SHA.LIN 评分和 S.T.O.N.E 评分的 ROC 曲线比较

通过绘制 ROC 曲线可知，SHA.LIN 评分的敏感性为 91.25%、特异性为 89.12%、曲线下面积（Area under curve，AUC）为 0.912(95%CI 0.869~0.948)；S.T.O.N.E 评分的敏感性为 78.75%、特异性为 84.24%、AUC 为 0.782 (95% CI 0.690~0.871)，见图 1。

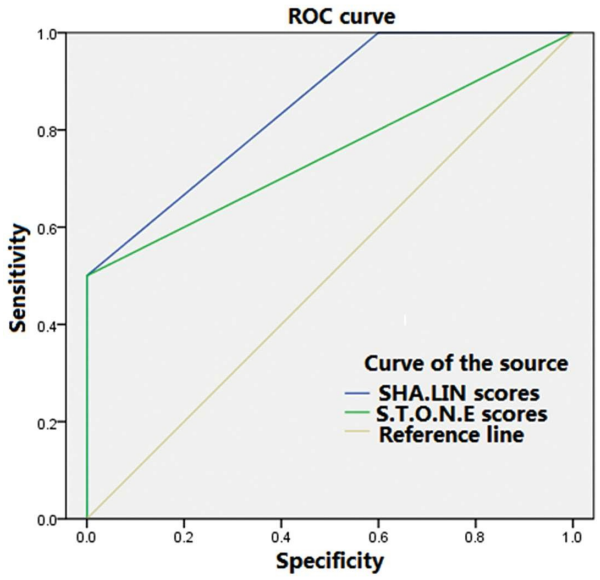

图 1 SHA.LIN 评分和 S.T.O.N.E 评分的 ROC 曲线

Fig. 1 The ROC curve of SHA.LIN and S.T.O.N.E scores

3 讨论

经皮肾镜取石术是肾结石临床治疗的首选治疗方案，有着较高的结石清除率，但因结石复杂程度、结石分布特点、手术操作等不同因素影响，患者在术后均有结石残留的可能[14,15]。因此，在手术前采取适当的方法对患者的结石情况进行多方面综合系统评估，以便制定更为合理的手术治疗方案，从而获得更好的结石清除效果[16,17]。目前，临床尚无统一认可的肾结石术前评估系统，因此，对于这种术前评估系统的研究已受到临床医师的高度关注。S.T.O.N.E 评分是目前常用的术前评估系统，但临床使用较为繁琐，且准确性有待提高，因此未得到广泛应用[18-20]。为此，在本研究在临床实践中经过一系列的探索建立了 SHA.LIN 评分系统，并与 S.T.O.N.E 评分相比，显示了良好的应用效果。

在本研究中，67 例患者术后结石清除者 49 例、结石残留者 18 例，结石清除率为 73.13%。结石残留组患者手术时间、术中失血量、住院时间、结石最大截面积、最大累积截面积、结石解剖分布肾盂的发生率、受累肾盏数均高于结石清除组，穿刺通道长度低于结石清除组（*P<0.05*），这是因为患者手术时间、术中出血量、住院时间较高时，患者预后效果较差，由此可能导致患者的结石残留，不利于术后排石。此外，结石清除组患者的 SHA.LIN 评分、S.T.O.N.E 评分均低于结石残留组（*P<0.05*），表明随着 SHA.LIN 评分、S.T.O.N.E 评分的升高，患者结石的复杂性增加，结石残留率也随之增加[21-23]。经多因素 Logistic 回归分析显示，手术时间、术中失血量、SHA.LIN 评分、S.T.O.N.E 评

分、受累肾盏数是结石残留的影响因素（*P<0.05*），表明患者手术时间越长、出血量越多，SHA.LIN 评分、S.T.O.N.E 评分、受累肾盏数等越高，患者的结石复杂性越大，术中难以完全清除[24,25]。通过绘制 ROC 曲线可知，SHA.LIN 评分敏感性、特异性、AUC 均高于 S.T.O.N.E 评分，可能因为 SHA.LIN 评分综合了多个影响患者结石残留率的因素，评价指标更为全面合理，从结石负荷、肾积水程度、穿刺通道长度、结实密度、结石分布、受累肾盏等 6 个方面对结石复杂情况及对术后结石残留率的影响进行综合评价[26,27]。S.T.O.N.E 评分系统中缺乏患者结石的解剖学分布这一重要的量化指标，仅有鹿角型结石这一指标被纳入，而 SHA.LIN 评分则是从中下盏、肾盂肾上盏、部分鹿角型、完全鹿角型等 4 个方面进行评价，因此 SHA.LIN 评分更为全面具体，对于结石清除率的敏感性、特异性更高[28-30]。SHA.LIN 评分系统也存在一些不足之处，由于医师的手术操作技巧、医师的经验判断等人为因素也可能影响患者术后结石清除状态，为此，今后考虑将这些因素纳入到评分系统中，使得该评分系统更为完善，进一步提高对结石清除率的预测准确度和预测价值。

综上所述，SHA.LIN 评分、S.T.O.N.E 评分均能预测患者的结石清除率，但 SHA.LIN 评分的敏感性、特异性高于 S.T.O.N.E 评分，对于结石清除率的预测价值更高。

参 考 文 献（References）

[1] Wei YP, Lin XG, He RQ, et al. Epidemiologic Association of Nonalcoholic Fatty Liver Disease and Urinary Calculi: a Population-based Cross-sectional Study in Southern China [J]. Iran J Kidney Dis, 2018, 12(2): 112-119

[2] Huang L, Lin Y, Tang Z, et al. Management of upper urinary tract calculi in crossed fused renal ectopic anomaly [J]. Exp Ther Med, 2018, 15(1): 371-376

[3] Goldstein B, Goldfarb DS. Early Recognition and Management of Rare Kidney Stone Disorders[J]. Urol Nurs, 2017, 37(2): 81-9, 102

[4] Kaya E, Ebiloğlu T, Zor M, et al. The outcome of percutaneous nephrolithotomy on ≥ 50 mm staghorn and multiple calyceal stones [J]. Turk J Urol, 2018, 44(2): 148-152

[5] Abbott JE, Davalos JG. Outpatient Tubeless Percutaneous Nephrolithotomy Performed in a Freestanding Ambulatory Surgery Center[J]. J Endourol Case Rep, 2018, 4(1): 28-31

[6] Ławiński J, Jabłonowski Z. The analysis of perioperative complications of percutaneous nephrolithotomy in the treatment of nephrolithiasis with the use of modified Clavien-Dindo classification [J]. Pol Merkur Lekarski, 2018, 44(260): 49-53

[7] Hatipoglu Z, Gulec E, Turktan M, et al. Comparative study of ultrasound-guided paravertebral block versus intravenous tramadol for postoperative pain control inpercutaneous nephrolithotomy [J]. BMC Anesthesiol, 2018, 18(1): 24

[8] Vicentini FC, Serzedello FR, Thomas K, et al. What is the quickest scoring system to predict percutaneous nephrolithotomy outcomes? A comparative study among S.T.O.N.E score, guy's stone score and croes nomogram[J]. Int Braz J Urol, 2017, 43(6): 1102-1109

[9] Choo MS, Jeong CW, Jung JH, et al. External validation and evaluation of reliability and validity of the S-ReSC scoring system to predict stone-free status after percutaneous nephrolithotomy[J]. PLoS One, 2014, 9(1): e83628

[10] Labadie K, Okhunov Z, Akhavein A. Evaluation and comparison of urolithiasis scoring systems used in percutaneous kidney stone surgery[J]. J Urol, 2015, 193(1): 154-159

[11] 彭国辉,李汉忠,张玉石,等.SHA．LIN 评分系统的建立及其在预测经皮肾镜取石术结石清除率中的价值 [J]. 中华泌尿外科杂志, 2015, 36(10): 746-751
Peng Gui-hui, Li Han-zhong, Zhang Yu-shi, et al. The establishment and evaluation of SHA.LIN nephrolithometry scoring system for predicting the stone-free rate of percutaneous nephrolithotomy [J]. Chinese Journal of Urology, 2015, 36(10): 746-751

[12] 刘亮程,滕东海,黄贵闽,等.肾结石评分分级系统对预测 PCNL 术后结石清除率的对比分析 [J]. 现代泌尿外科杂志, 2017, 22(10): 756-760, 806
Liu Liang-cheng, Teng Dong-hai, Huang Gui-min, et al. Comparison of three renal stone scoring systems in predicting the accuracy of percutaneous nephrolithotomy outcomes [J]. Journal of Modern Urology, 2017, 22(10): 756-760, 806

[13] Shadman A, Bastani B. Evaluation and Management of Kidney Calculi[J]. Iran J Kidney Dis, 2017, 11(6): 395-407

[14] Kumar U, Tomar V, Yadav SS, et al. STONE score versus Guy's Stone Score - prospective comparative evaluation for success rate and complications in percutaneous nephrolithotomy [J]. Urol Ann, 2018, 10(1): 76-81

[15] Sun W, Liu MN, Yang ZW, et al. Ultrasound-guided percutaneous nephrolithotomy for the treatment in patients with kidney stones[J]. Medicine (Baltimore), 2017, 96(51): e9232

[16] Keshavamurthy R, Kumar S, Karthikeyan VS, et al. Tubeless Pediatric Percutaneous Nephrolithotomy: Assessment of Feasibility and Safety[J]. J Indian Assoc Pediatr Surg, 2018, 23(1): 16-21

[17] Soares RMO, Glaser AP, Cohen JE, et al. Bilateral Prone Percutaneous Nephrolithotomy Under Epidural in Candidate for Lung Transplant: Case Report and Review of Literature[J]. J Endourol Case Rep, 2018, 4(1): 5-8

[18] Wei Gan JJ, Lia Gan JJ, Hsien Gan JJ, et al. Lateral percutaneous nephrolithotomy: A safe and effective surgical approach [J]. Indian J Urol, 2018, 34(1): 45-50

[19] González-Rodríguez MA, Maldonado-Alcaraz E, Serrano-Brambila EA, et al. The use of S.T.O.N.E. scale in patients undergoing percutaneous nephrolithotomy [J]. Arch Esp Urol, 2015, 68 (9): 685-691

[20] Sfoungaristos S, Gofrit ON, Yutkin V, et al. Evaluating Parameters Affecting Fluoroscopy Time During Percutaneous Nephrolithotomy: Focus on the Predictive Role of Guy's, S.T.O.N.E., and CROES Scoring Systems[J]. J Endourol, 2015, 29(12): 1366-1370

[21] Noureldin YA, Elkoushy MA, Andonian S. Which is better? Guy's versus S.T.O.N.E. nephrolithometry scoring systems in predicting stone-free status post-percutaneous nephrolithotomy[J]. World J Urol, 2015, 33(11): 1821-1825

[22] Noureldin YA, Elkoushy MA, Andonian S. Predictors of fluoroscopy time during percutaneous nephrolithotomy: impact of postgraduate urology trainees and S.T.O.N.E. nephrolithometry score [J]. J Endourol, 2015, 29(5): 542-547

（下转第 3983 页）

[7] Ozkaya I, Yardimci B, Tunckale A, et al. Appropriate neck circumference cut-off points for metabolic syndrome in Turkish patients with type 2 diabetes [J]. Endocrinologia, diabetesy nutricion, 2017, 64(10): 517-523

[8] Limpawattana P, Manjavong M, Sopapong R. Can neck circumference predict metabolic syndrome? An experience from a university community [J]. Endocrine practice: official journal of the American College of Endocrinology and the American Association of Clinical Endocrinologists, 2016, 22(1): 8-15

[9] Wang X, Zhang N, Yu C, et al. Evaluation of neck circumference as a predictor of central obesity and insulin resistance in Chinese adults[J]. International journal of clinical and experimental medicine, 2015, 8 (10): 19107-19135

[10] Cizza G, Jonge L, Piaggi P, et al. Neck circumference is a predictor of metabolic syndrome and obstructive sleep apnea in short-sleeping obese men and women[J]. Metabolic syndrome and related disorders, 2014, 12(4): 231-241

[11] Cui T, Yan BH, Liu Z, et al. Neck circumference: A valuable anthropometric measurement to detect metabolic syndrome among different age groups in China [J]. Diabetes/metabolism research and reviews, 2018, 34(3)

[12] Tibana RA, Teixeira TG, Farias DL, et al. Relation of neck circumference and relative muscle strength and cardiovascular risk factors in sedentary women[J]. Einstein(Sao Paulo), 2012, 10(3): 329 -334

[13] Stabe C, Vasques AC, Lima MM, et al. Neck circumference as a simple tool for identifying the metabolic syndrome and insulin resistance: results from the Brazilian Metabolic Syndrome Study[J]. Clinical endocrinology, 2013, 78(6): 874-881

[14] Svley Ah, Hayriye EA, et al. Neck circumference, metabolic syndrome and obstructive sleep apnea syndrome; Evalution of possible linkage[J]. Clinical Reseach, 2013, 19: 111-117

[15] Joshipura K, Joshipura K, Vergara J, et al. Neck Circumference May Be a Better Alternative to Standard Anthropometric Measures [J]. Journal of diabetes research, 2016, 6058916

[16] Nicklas BJ, Penninx BW, Cesari M, et al. Association of visceral adiposetissue with incident myocardial infarction in older men and women: thehealth, aging and body composition study [J]. Am J Epidemiol, 2004, 160: 74

[17] 陈颖超, 洪洁. 颈围: 一项检测心血管疾病风险因素的新指标[J]. 内科理论与实践, 2011, 6(6): 448-450
Chen Ying-chao, Hong Jie. Neck circumference -A new measure of risk factors for cardiovascular disease [J]. Internal Medicine Theory and Practice, 2011, 6(6): 448-450

[18] DiranM, Xie J, Fenwick E, Benarous R, et al. Are obesity and anthropometry risk factors for diabetic retinopathy? [J]. Invest Ophthalmol Visual Science, 2011, 52(7): 4416-4421

[19] Li P, Lin S, Cui J, et al. First Trimester Neck Circumference as a Predictor for the Development of Gestational Diabetes Mellitus [J]. The American journal of the medical sciences, 2018, 355(2): 149-152

[20] Kashine S, Kishida K, Kunahashi T, et al. Selective contribution of waist circumference reduction on the improvement of sleep-disordered breathing in patients hospitalized with type 2 diabetes mellitus[J]. Internal Medicine, 2011, 50(18): 1895-903

[21] Medeiros CA, Bruin VM, Castro-Silva Cd, et al. Neck circumference, a bedside clinical feature related to mortality of acute ischemic stroke [J]. Revista da Associacao Medica Brasileira, 2011, (5): 559-564

[22] Vallianou NG, Evangelopoulos AA, Bountziouka V, et al. Neck circumference is correlated with triglycerides and inversely related with HDL cholesterol beyond BMI and waist circumference [J]. Diabetes/metabolism research and reviews, 2013, 29(1): 90-97

（上接第 3971 页）

[23] Akhavein A, Henriksen C, Syed J, et al. Prediction of single procedure success rate using S.T.O.N.E. nephrolithometry surgical classification system with strict criteria for surgical outcome [J]. Urology, 2015, 85(1): 69-73

[24] Sharma K, Goel A, Gupta S. Re: Okhunov et al. S.T.O.N.E. nephrolithometry: novel surgical classification system for kidney calculi(Urology 2013;81:1154-1160)[J]. Urology, 2013, 82(4): 979

[25] Okhunov Z, Helmy M, Perez-Lansac A, et al. Interobserver reliability and reproducibility of s.T.o.N.e. Nephrolithometry for renal calculi[J]. J Endourol, 2013, 27(10): 1303-1306

[26] Sabnis RB, Ganesamoni R, Doshi A, et al. Micropercutaneous nephrolithotomy (microperc) vs retrograde intrarenal surgery for the management of small renal calculi: a randomized controlled trial[J]. BJU Int, 2013, 112(3): 355-361

[27] 彭国辉,李汉忠,李秉诚,等.SHA.LIN、S.T.O.N.E 评分系统和 Guy's 分级法预测经皮肾镜取石术结石清除率准确性的比较研究 [J].中华泌尿外科杂志, 2016, 37(3): 199-205
Peng Guo-hui, Li Han-zhong, Li Bing-cheng, et al. Evaluation and comparison of SHA.LIN, S.T.O.N.E nephrolithometry scoring system and Guy's stone score in predicting the accuracy of the percutaneous nephrolithotomy (PCNL) outcomes [J]. Chinese Journal of Urology, 2016, 37(3): 199-205

[28] Mitsui Y, Wada K, Araki M, et al. Ureterolithotripsy for a Ureteral Calculus at the Ureteroureterostomy of a Renal-transplant Recipient [J]. Acta Med Okayama, 2017, 71(5): 449-452

[29] Scarpa RM, Scoffone CM, Cracco CM. Letter about: Treatment for residual stones using flexible ureteroscopy and holmium laser lithotripsy after the management of complex calculi with single-tract percutaneous nephrolithotomy[J]. Lasers Med Sci, 2018, 33(2): 451

[30] 郑浩,侯建全,魏雪栋,等.彩色多普勒超声引导下经皮肾镜取石术(PCNL) 治疗复杂性肾结石的临床分析 [J]. 现代生物医学进展, 2014, 14(2): 313-315, 360
Zheng Hao, Hou Jian-quan, Wei Xue-dong, et al. The Effect of Percutaneous nephrolithotomy in the Treatment of Complicated Renal Calculi under Color Doppler Ultrasound Guidance[J]. Progress in Modern Biomedicine, 2014, 14(2): 313-315, 360