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Predictors of intervention in Steinstrasse following shock wave lithotripsy (SWL)

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Abstract :
Introduction Steinstrasse (SS) is a well known complication of shock wave lithotripsy (SWL)and occurs in 2-10 of cases. The majority of SS clears spontaneously whereas about 6 require intervention. This study was carried out to see whether the need for intervention in SS could be predicted.Material and method This was a retrospective study spanning 6 years. It included all patients who had steinstrasse following SWL at our center. They were divided into two groups A) Those who cleared steinstrasse spontaneously and B) Those required interventions. The two groups were compared with regard to demographic profile, stone factors and steinstrasse factors. Steinstrasse was classified according to Coptcoat classification.Results Out of 2436 only 89 (3) formed steinstrasse. The majority of the patients (35) who formed steinstrasse and who required intervention were in the group 10-14mm. Coptcoat type III steinstrasse required significantly more interventions for clearance (p0.001). The site and the size of the SS was not a predictor of intervention of SS.Conclusions Early intervention is warranted in patients with steinstrasse where the lead fragment is 5mm (Coptcoat type III).
Keyword : Steinstrasse (SS), Shock wave lithotripsy (SWL), Interventions

Introduction:

The production and distribution of the Dornier HM3 lithotripter began in later part of 1983, after the pioneering works of Dornier, at the Urology university at Munich. Shock wave lithotripsy (SWL) was approved by the U.S. Food and Drug Administration in 1984[1]. There are more than 3000 lithotripters worldwide and more than 1 million patients are treated annually with SWL. Steinstrasse or “stone street,” is an aggregation of particles in the ureter formed following extra corporeal shock wave lithotripsy (SWL). It is a well-recognized, but transient and asymptomatic complication of SWL. It is also a common radiological finding on routine

radiographic images which is taken between 24 and 48 hours after lithotripsy (15%)[2]. Steinstrasse has been classified by Coptcoat into 3 types - Type I is made up of particles 2 mm in diameter or smaller. Type II has a leading large fragment of 4 mm to 5 mm in diameter with a tail of 2-mm particles. Type III is composed of large fragments >5mm[2]. Patients with steinstrasse are initially treated conservatively but in case of obstruction, infection, pain or failed passage of the calculus fragments further treatment is recommended. The various modalities of treatment ranges from repeated SWL to the leading fragment, percutaneous nephrostomy (PCN), endoscopic manipulation and finally open surgery[3]. In this study we tried to determine whether it was possible to predict the need for intervention in a patient with steinstrasse so that prompt intervention can be carried out, thereby reducing the waiting period.

Materials and method:

This was a retrospective study spanning six years from June 2005 to June 2011. All patients who had developed steinstrasse following SWL for renal/ureteric calculi were eligible for inclusion. A Dornier compact Delta II Lithotripter was used for SWL in all cases. Sedoanalgesia (5mg morphine and 25mg Pethidine) was used with electrocardiogram and pulse oximeter monitoring. Shock sequence was performed using gradual ramping - it started at 8Kv and then gradually increased to 14Kv for renal calculi and 16Kv for ureteral calculi. It was increased one level after each set of 25 shocks at a frequency of 70/ min for renal and 80/ min for ureter. Renal stones were given 1500 shocks / session whereas ureteric stones 2000 shocks / session. X rays were done at 7 days following SWL. All patients received alpha blockers (tamsulosin 0.4mg) post-SWL. Steinstrasse was defined as an aggregation of stone particles in the ureter seen on a plain X ray post SWL and the Coptcoat classification was used. The standard indications for intervention in steinstrasse are - rising creatinine levels, urosepsis and failure to pass fragments within a reasonable time. Steinstrasse should also be treated if it is symptomatic (pain and sepsis) or causes a silent obstruction over a 30-day period[9]. Treatment options include placement of a percutaneous tube to allow fragments to pass, ureteroscopy and transureteral lithotripsy, SWL of a lead fragment or open ureterolithotomy[3]. At our center we observe patients with steinstrasse for 2 weeks if the patient has graveluria and is otherwise asymptomatic. However if he/ she does not pass anything for 1 week, intervention is planned as our patients come from further areas. PCN was considered if there were features of sepsis. Patients with steinstrasse were divided into two groups. Group A (n=42) comprised of patients where there was spontaneous clearance of steinstrasse and Group B (n=47) were patients who required intervention. The 2 groups were compared with regard to demographic profile (age, sex, comorbidities), stone factors (original size, side involved, site of calculi, obstruction) and steinstrasse factors (Coptcoat type, length of steinstrasse, site of steinstrasse) to determine any predictive factors for intervention.

Results and observations

CONSORT diagram for our study is shown in Figure 1. Of 2436 patients who received SWL, only 89 (3%) formed steinstrasse. Of the 89 patients forming steinstrasse 42(47%) had spontaneous clearance and 47 (53%) required interventions. Thirty-seven required SWL to the lead fragment, 6 required PCN insertion and 4 required URS and DJ stenting.

Table 2 shows the demographic profile of both the groups. Both the groups were comparable in regards to their demographic profile. Most of the patients who formed steinstrasse and who required intervention were in the group 10-14mm as shown in Table 3. Though larger stones were more liable to form steinstrasse, the initial stone size did not correlate with need for intervention (Table 3). Grade of hydronephrosis had no association with the clearance of the steinstrasse (p=0.2). Coptcoat type III steinstrasse required significantly more interventions for clearance (p=0.001) as evidenced in Table 4. Most of the steinstrasse were located in the distal ureter (77%),followed by the proximal ureter (17%) and the distal ureter (6%). The site or the length of the steinstrasse were not significantly associated the requirement of intervention (Table 5).

Discussion

With the advent of better Lithotriptors and use of PCNL for the treatment of calculi larger than 2cm the incidence of steinstrasse has dramatically fallen[4]. In early studies of SWL, steinstrasse was common, occurring in up to 20% of patients[5]. However after refining the technique like gradual ramping, gradual increase in the number of shocks (kV), low energy shock wave for disintegration of the stones and also better lithotripters the incidence of steinstrasse decreased. The incidence of steinstrasse was 6% in the series of Kim et al[6] whereas the incidence of steinstrasse in our series was only 3%. Madbouly et al in their study of 4,634 patients found the incidence of steinstrasse to be 3.97%.[11] Most of the steinstrassewere located in the distal ureter (77%), followed by the proximal ureter (17%) and the distal ureter (6%). This was similar to the results of Sayed et al. [7] who found that the most common location for steinstrasse was the distal ureter (64%) followed by the proximal (29%) and mid-ureter (8%). Fedullo et al also found that nearly 75% of steinstrasse were in the lower ureter[5].Contrary to the findings by several groups that larger stones formed larger steinstrasse[2,5,6] we found that most of the steinstrasse were formed by the calculus size between 10 -14mmIt was shown that the use of DJ stents preoperatively lowers the incidence of steinstrasse in stones size more than 1.5 cm[8]. However, none of the patients in our study were stented prior to the SWL. The use of tamsulosin, an 1A and 1D receptor antagonist concurrently with SWL improves the outcome of steinstrasse[10]. In this series both the control and the study group received tamsulosin.Unlike Madbouly K. et al[11] who showed that the size and the site are significant predictive factors controlling steinstrasse formation we didn't have a similar observation. They showed that the chance of steinstrasse formation was 3.7 times less when stone size was less than 2 cm. They further showed that the incidence of steinstrasse was 2.7 times less for lumbar ureteral stones compared to renal stones. Many studies have showed that high renal intra pelvic pressure is associated with reduced or absent renal pelvic motility and thereby inhibiting pelvic and ureteral peristalsis [12]. Hence, radiologically dilated systems have less propulsive power and decreased antegrade fluid pressure with more probability of failure of lithotripsy. However, in the present study the grade of hydronephrosis didn't have any affect on the clearance of steinstrasse (p=0.2). In our study, the need for intervention was not shown to be significantly associated with the length of the steinstrasse (p=0.274). This was also shown by Sayed et al in a study of 885 patients with urinary

stones (650 renal and 235 ureteric).
The only factor which we found to be significantly associated with the prediction for intervention was Coptcoat type III (p=0.001). This was demonstrated by Coptcoat[2] in 1988. His study concluded that type III will always require intervention and there is little to be gained by waiting for spontaneous passage. Another study of 1647 patients found that 12 and 17 patients formed Coptcoat type II and III steinstrasse. Most cleared with SWL to the leading fragment. Only 2 in the type III steinstrasse required additional interventions like DJ stenting and PCN [13]. Weakness: Being a retrospective study this had its inherent weakness. There were no solitary kidney in the study.

Conclusion:
Based on our study, patients with steinstrasse in whom the lead fragment is >5mm (Coptcoat type III) are those in whom early intervention seems warranted.

References:

1 Chaussy C, Schmiedt E, Jocham D, et al: First clinical experience with extracorporeally induced destruction of kidney stones by shock waves. J Urol 1982;127:417

2 Coptcoat MJ, Webb DR, Kellet MJ, Whitfield HN, Wickham JE. The steinstrasse: A legacy of extracorporeal lithotripsy? Eur Urol. 1988;14:93-95.

3 Goyal R, Dubey D, Khurana N et al. Does the type of steinstrasse predict the outcome of expectant therapy? Indian J Urol. 2006;22:135-138.

4 Fletcher M, Dickinson I, Coptcoat MJ et al. The combination of PCNL and ESWL for the treatment of large renal calculi. Br. J. Urol.1986; 58:581-583.

5 Fedullo LM, Pollack HM, Banner MP, Amendola MA, Van Arsdalen KN. The development of steinstrassen after ESWL. Frequency, natural history and radiologic management. AM J Roentgenol 1988; 151: 1145-1147.

6 Kim SC, Oh CH, Moon YT, Kim KD. Treatment of steinstrasse with repeat extracorporeal shock wave lithotripsy: experience with piezoelectric lithotripter. J Urol 1991; 145: 489-491

7 M.A.B. Sayed, A.M. El-Taher, H.A. Aboul-Ella, S.E. Shaker. Steinstrasse after extracorporeal shockwave lithotripsy: aetiology, prevention and management. BJU International 2001; 88; 675-678

8 Al-Awadi KA, Abdul Halim H, Kehinde EO, Al-Tawheed A. Steinstrasse: a comparison of incidence with and without J stenting and the effect of J stenting on subsequent management. BJU Int. 1999;84:618-621.

9 Satar N, Doran S, Ozkeceli R, Turkyilmaz RK.Treatment of multiple small stone particles (steinstrasse) in the lower ureter after theextracorporeal shock wave lithotripsy treatment. Tr J Med Sci.1998;28:269-271.

10 Bhagat SK, Chacko NK, Kekre NS, Gopalakrishnan G, Antonisamy B, Devasia A. Is there a role for tamsulosin in shock wave lithotripsy for renal and ureteral calculi?J Urol. 2007 Jun;177(6):2185-

11 Madbouly K, Sheir Kz, Elsobky E, Eraky I, Kenawi M. Risk factors for the stone formation of a stein-strasse after extracorporeal shock wave lithotripsy. J Urol. 2002 Mar;167:1239–1242.

12 Ryan, P. C., Lennon, G. M., McLean, P. A. et al: The effects of acute and chronic JJ stent Table 2 Showing the - Demographic profile

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placement on upper urinary tract motility and calculus transit. Br J Urol. 1994 Oct;74(4):434-439.

13 Abdulmalik M Tayib, Hisham A Mosli, Hasan M Farsi, Mahmoud A Atwa, Hisham A Saada. Five Years Experience in the Management of Steinstrasse Post Shock Wave Lithotripsy JKAU: Med. Sci 01/2008; 15:71-79.

	Group A	Group B	p value
Mean Age± SD (years)	44.38±1.13	46.8±1.39	0.374
Sex (%male)	76.2	76.6	0.5
Comorbidities (%)	11.8	23.3	0.4

Table 3- Size of the stone and formation of Steinstrasse

Stone size (mm)	Group A (%)	Group B (%)	P value
0-9	16.7%	11%	0.1
10-14	50%	35%	
15-19	23.8%	28%	
>20	9.5%	26%	

Table 4- Showing type of Coptcoat and intervention

Stone factors	Group A	Group B	Level of significance
Coptcoat Type			
I	19 (45%)	10 (21.3%)	**0.001**
II	18 (42.9%)	0 (0%)	
III	5 (11.9%)	37 (78.7%)	

Table 5- Length of the SS and intervention

Stone factors	Group A	Group B	Level of significance
Length of steinstrasse (mm)			
<30	22 (53%)	20(42.5%)	0.274
30-49	18 (42.2%)	18 (38.3%)	
>50	2 (4.8%)	9 (19.2%)	