International Surgery Journal
Sarpal R et al. Int Surg J. 2018 Mar;5(3):860-863
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20180435

Original Research Article

Preventive role of aminophylline on renal vascular changes among shock wave lithotripsy patients

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Received: 17 January 2018
Revised: 22 January 2018
Accepted: 27 January 2018

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ABSTRACT

Background: Shock wave lithotripsy is commonly used procedure for the treatment of urinary calculi which has revolutionized the treatment of urinary lithiasis since 19801. This study was undertaken to study the effect of aminophylline as a protective measure in preventing renal microvascular damage following SWL through RI in a prospective randomised controlled fashion.
Methods: This prospective randomized experimental case control study was conducted from September 2010 to August 2011 at a tertiary care urological hospital. Total 52 patients with less than 2cm size renal stones were divided in two groups of 26 patients each.
Results: Stone characteristics as site, size, laterality and Hounsfield units (HU) were comparable in both the groups. Mean RI of diseased and contralateral kidneys in group 'A' showed statistically significant rise at 4 hours, 12 hours and 24 hours, with no significant difference in RI at one week and one month. Complete stone clearance was achieved in immediate post-operative period in 88.46% of cases in group A and 96.1% in group B.
Conclusions: Author conclude protective effect of aminophylline over renal vascular injury in shock wave lithotripsy patients in form of early return of resistive index values toward baseline.

Keywords: Aminophylline, Shock wave lithotripsy, Urinary calculi

INTRODUCTION

Shock wave lithotripsy (SWL) is commonly used procedure for the treatment of urinary calculi which has revolutionized the treatment of urinary lithiasis since 1980.[1] Dynamic and mechanical forces of SWL causes haemorrhage and inflammatory cytokine release which can lead to vasoconstriction followed by impaired renal plasma flow.[2] Adenosine has been suggested as a possible mediator of renal vasoconstriction after physiologic insults to the kidney. Aminophylline which blocks the effects of adenosine through competitive antagonism, have been used in several studies to improve compromised renal function induced by ischemia.[3] Renal vascular changes can be interpreted by measuring resistive index (RI) of renal interlobar arteries with non-invasive spectral Doppler study. This study was undertaken to study the effect of aminophylline as a protective measure in preventing renal microvascular

damage following SWL through RI in a prospective randomised controlled fashion.

METHODS

This prospective randomized experimental case control study was conducted from September 2010 to August 2011 at a tertiary care urological hospital. Ethical clearance was taken from local institutional ethics committee. Patients and attendants were informed regarding the investigational nature of the procedure and written informed consent was taken. Patients undergoing multiple procedures during same admission as percutaneous nephrolithotomy, uretrorenoscopy etc were excluded. Those patients who have any contraindications for administering intravenous aminophylline such as history of seizures, arrhythmia resulting in circulatory instability were also not included. Total 52 patients with less than 2cm size renal stones were divided in two groups of 26 patients each, by simple randomisation using random number table. Both urologist and radiologist were blinded to the randomisation. RI was measured before SWL, at 4 hours, at 12 hours and at day one, seven and one month in both groups. After 30 minutes of SWL, group 'B' patients were intravenously infused aminophylline for 48 hours. Statistical evaluation was done using SPSS 17. Continuous data was analysed using the Students "t" test to compare the two means. Categorical data between the groups was analysed by Chi square test. p values <0.05 and <0.001 were considered significant and highly significant respectively.

RESULTS

Mean age of patient in the group A was 38.8±14.4 (range of 12 to 66 years), whereas it was 41.6±12.3 (range of 21 to 69 years) in the group B. Male to female ratio was 17:9 and 20:6 in groups A and B respectively. Stone characteristics as site, size, laterality and Hounsfield units (HU) were comparable in both the groups. Five patients in group A and 3 in group B had diabetes mellitus while three patients in group A and one in group B had hypertension. Total number of shocks given in group A was 1385±379 and that in group B were 1315±302. Shocks were administered under both fluoro and USG guidance. The mean fluoro time in Group A was 3.8±2.1minutes and that in group B was3.9±1.9 minutes. Baseline RI of ipsilateral kidneys was 0.57±0.04 and 0.57±0.05 in group 'A' and group 'B' respectively. While baseline RI of contralateral kidneys was 0.57±0.05 and 0.56±.05 in group 'A' and group 'B' respectively. Mean RI of diseased and contralateral kidneys in group 'A' showed statistically significant rise at 4 hours, 12 hours and 24 hours, with no significant difference in RI at one week and one month (Table 1). Mean RI of ipsilateral and contralateral kidneys in group 'B' showed statistically significant rise at 4 hours, 12 hours only and not beyond that. RI returned to pre SWL value at 24 hours and slightly decreased below baseline at seven days and one month (Table 2).

Table 1: Changes in resistive index in both the kidneys of group A (without aminophylline).

Time	Ipsilateral RI	p-value*	Contralateral RI	p-value*
Baseline	0.57±0.04	-	0.57±0.05	
4 hrs	0.64±0.06	<0.001	0.64±0.05	<0.001
12 hrs	0.63±0.05	<0.001	0.63±0.05	<0.001
24 hrs	0.61±0.04	<0.001	0.61±0.05	<0.001
7 days	0.58±0.04	0.147	0.58±0.05	0.356
1 month	0.57±0.05	0.794	0.58±0.05	0.725

*p- value compared with baseline value

Table 2: Changes in resistive index in both the kidneys of group B (with aminophylline).

Time	Ipsilateral RI	p-value*	Contralateral RI	p-value*
Baseline	0.57±0.05	-	0.56±0.05	
4 hrs	0.58±0.05	<0.001	0.58±0.06	<0.001
12 hrs	0.57±0.05	0.002	0.58±0.05	0.001
24 hrs	0.57±0.04	0.821	0.57±0.05	<0.001
7 days	0.56±0.05	0.040	0.56±0.05	0.228
1 month	0.56±0.05	0.003	0.56±0.05	0.022

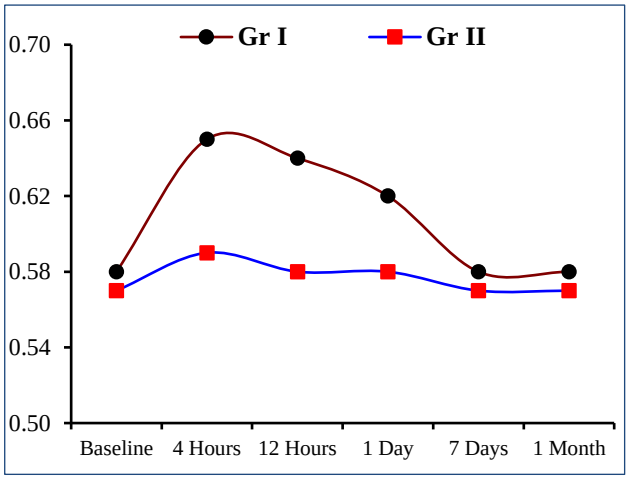

Figure 1: Changes in RI of Ipsilateral side in both groups.

On statistical analysis, RI of the SWL treated kidneys in both groups A and B, the difference in resistive index was significant at 4 hours, 12 hours and 24 hours while comparing to baseline (Figure 1). Similar difference was noted in normal kidneys at 4 hours, 12 hours, and 24 hours. Complete stone clearance was achieved in immediate post-operative period in 88.46% of cases in group A and 96.1% in group B. While one-month complete clearance was achieved in 88.46% of cases in group A and 92.3% of cases in group B. Stone clearance rate were not statistically significant in both groups.

DISCUSSION

Shock wave lithotripters are worldwide available and acceptable non-invasive tool for effectively treating small sized renal stones. Shock waves stone fragmentation works on cavitation bubble collapse, shear and spalling forces.[4] These forces cause trauma to adjacent thin walled renal vessels, which may result in short and long-term complications such as subcapsular hematoma, perinephric hematoma, hypertension and chronic deterioration in renal function.[5]

In present study RI values were significantly raised up to 24 hours for both ipsilateral and contralateral kidneys in group 'A' while it showed significant rise up to 12 hours only in group 'B'.

In 23 treated patients with Dornier MPL 9000 Kataoka et al observed significantly diminished renal blood flow velocity in the area exposed to shock were immediately after the treatment, which returned to the pre-treatment levels after 1 week. The changes were not significant in the non-exposed area.[6]

Knapp et al performed 152 ESWL with a Dornier HM5 lithotriptor under epidural anaesthesia. They noticed significant resistive index increases in the treated kidneys, which were confirmed by the paired t test. The contralateral untreated kidneys showed no significant changes in resistive index before and after lithotripsy.[7]

Aoki et al performed 70 ESWL with EDAP LT-01 lithotriptor without anaesthesia. Significantly increased RI from 0.656±0.053 at baseline to 0.682±0.053 (P <0.0001) were noted in the treated kidneys. There was no significant correlation of increase in RI with patient age or with pre-ESWL blood pressure.[8]

Mohseni MG et al noted increase in RI near calculi 30 minutes after ESWL which returned to pre ESWL values 1 week later. They concluded no relationship of age, gender, weight; blood pressure and smoking with RI values of ESWL treated kidneys.[9]

Ali Z et al reported significant increase in RI 30 minutes post ESWL. They also revealed that mean RI did not return to pre ESWL level after 1 week.[10]

Chan et al studied protective effect of aminophylline on renal vascular change among ten shock wave lithotripsy patients using gadolinium triamino penta acetic acid (Gd-DTPA) enhanced first pass perfusion MRI. They demonstrate reduction of cortical flow in post lithotripsy patients without aminophylline infusion, while no significant difference in relative perfusion was noticed in aminophylline infusion group patients.

In the present study author also noted protective effect of aminophylline in 26 post lithotripsy patients using resistive index as RI of kidneys returned to baseline earlier when aminophylline was administered.

CONCLUSION

Shock wave lithotripsy is commonly used procedure for the small sized renal calculi. During the breakdown of calculi shockwaves damage renal vessels leading to decrease in renal plasma flow. These changes are well noticed with resistive index of Colour Doppler scan. Author conclude protective effect of aminophylline over renal vascular injury in shock wave lithotripsy patients in form of early return of resistive index values toward baseline.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Chaussy C, Schuller J and Schmiedt E. Extracorporeal shock-wave lithotripsy (ESWL) for treatment of urolithiasis. Urol. 1984;23:59-66.
2. Williams CM, Kaude JV, Newman RC, Peterson JC, Thomas WC. Extra corporeal shock-wave lithotripsy: long term complications. JR. 1988;150:311-5.
3. Chan AJ, Prasad PV, Priatna A, Mostafavai MR, Sunduram C, Saltzman B. Protective effect of aminophylline on renal perfusion changes induced by high-energy shockwaves identified by Gd-DTPA-enhanced first-pass perfusion MRI. J Endourol. 2000;14:117-21.
4. Moody JA, Evans AP, Lingeman JE. Extracorporeal shockwave lithotripsy. Weiss RM, George NJR, O'Reilly PH, eds. Comprehensive Urol. Mosby International Limited; 2001:623-636.
5. Evan AP, McAteer JA. Q-effects of shock-wave lithotripsy. In Kidney Stones: Medical and Surgical Management, edited by Coe FL, Favus MJ, Pak CYC, Parks JH. Preminger (Lippincott-Raven, Philadelphia; 1996:549-570.
6. Kataoka T, Kasahara T, Kobashikawa K, Masuyama T, Watanabe K, Saito T, et al. Changes in renal blood flow after treatment with ESWL in patients with renal stones. Studies using ultrasound color Doppler method. Nihon Hinyokika Gakkai zasshi. Japanese J Urol. 1993;84(5):851-6.
7. Knapp R, Frauscher F, Helweg G, Zur Nedden D, Strasser H, Janetschek G, et al. Age-related changes in resistive index following extracorporeal shock wave lithotripsy. J Urol. 1995;154(3):955-8.
8. Aoki Y, Ishitoya S, Okubo K, Okada T, Maekawa S, Maeda H, et al. Changes in resistive index following extracorporeal shock wave lithotripsy. Int J Urol. 1999;6(10):483-92.
9. Mohseni MG, Khazaeli MH, Aghamir SMK, Biniaz F. Changes in Intrarenal Resistive Index Following

Electromagnetic Extracorporeal Shock Wave Lithotripsy. J Urol. 2007;4(4):217-20.
10. Ali Z, Ali G, Tarzamni MK, Goldust M, Mirabad M RG, Nezami N. Renal Vascular Doppler Resistance after Extracorporeal Shock Wave Lithotripsy. Renal Failure J. 2013;35(5):686-90.

Cite this article as: Sarpal R, Goyal M, Pathak P, Ganesamoni R, Sabnis RB. Preventive role of aminophylline on renal vascular changes among shock wave lithotripsy patients. Int Surg J 2018;5:860-3.