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Urological Research

The role of open surgery

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Since the introduction of extracorporeal shock-wave lithotripsy (ESWL) and endourologic operating techniques, the number of open renal stone operations has drastically descreased. Figure 1 demonstrates how since 1985, when we started using these modern procedures, the amount of patients with stones has heavily increased concomitantly with a rapid decrease in the number of open operations.

The use of modern modalities is uncontested in stones that present no difficulties, but opinions differ in the treatment of large stones and staghorn calculi. Especially when staghorn stones are concerned, one encounters the most contradictory statistics of success along with all sorts of proposed treatment. Urologists who have years of experience in stone treatment by open surgery but have also gained experience in the new therapeutic modalities may show a preference for surgery. Considering that ESWL necessitates several sessions, possibly additional auxiliary measures and an immense number of X-ray examinations, it is easy to understand why open operation is chosen. However, is this really the best solution?

The treatment of staghorn stones is one of the main issues in the discussion of open stone surgery. It is important to define these calculi as exactly as possible at every discussion. We define them according to Rocco's classification. In the following we deal with C_4 and C_5 stones (Fig. 2).

Whereas a C_4 concrement is described as a stone mass filling the renal pelvis as well as one or maximally two calices, a C_5 stone fills more than 80% of the collecting system plus all calices. Since we previously removed staghorn calculi using local hypothermy, we have the possibility of comparing former anatrophic nephrolithotomy with percutaneous litholapaxy as well as ESWL monotherapy.

Between 1982 and 1987 we treated 108 patients with staghorn calculi; 71 subjects had C_4 stones and 37, C_5 stones. The patients underwent either anatrophic nephrolithotomy or a combination of percutaneous litholapaxy plus ESWL or ESWL monotherapy with or without a preoperatively placed double-J stent (Table 1). We performed anatrophic nephrolithotomy until 1985, generally using hypothermy. In 1985 we started applying other therapeutic modalities. Percutaneous nephrolithotomy was used in debulking with subsequent ESWL. From 1986 on, we mainly placed double-J stents prior to ESWL.

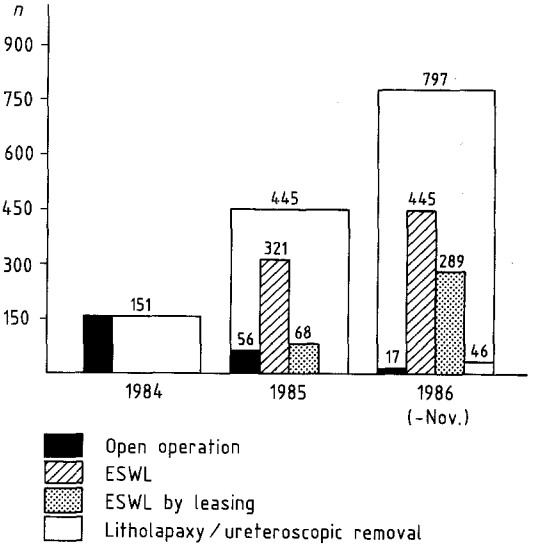

Fig. 1. Relationship of stone operations to ESWL treatment and number of patients

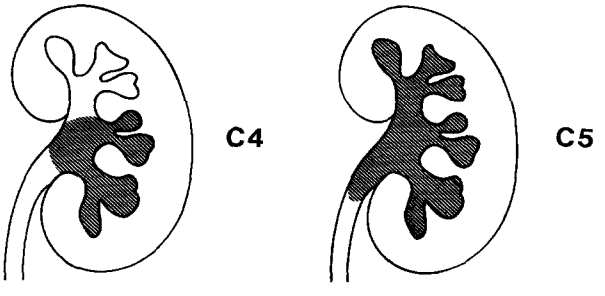

Fig. 2. Distribution of kidney staghorn calculus after Rocco

Table 1. Stone procedures ($n = 108$)

Anatrophic nephrolithotomy [AN]:		29
Percutaneous litholapaxy [PL] + ESWL:		21
ESWL monotherapy:	⊖ stent:	37
	⊕ stent:	21

Table 2. Stone-free (C_4 stones) ($n = 71$ patients)

AN ($n = 20$)		PL + ESWL ($n = 13$)		ESWL ⊖ ($n = 21$)		ESWL ⊕ ($n = 17$)	
n	%	*n*	%	*n*	%	*n*	%
18	90	11	85	11	52	15	88

Table 3. Stone-free (C_5 stones) ($n = 37$ patients)

AN ($n = 9$)		PL + ESWL ($n = 8$)		ESWL ⊖ ($n = 16$)		ESWL ⊕ ($n = 4$)	
n	%	*n*	%	*n*	%	*n*	%
7	78	6	75	7	44	3	75

Table 4. Auxiliary procedures (P): C_4 stones ($n = 71$ patients)

	AN ($n = 20$)		PL + ESWL ($n = 13$)		ESWL ⊖ ($n = 21$)		ESWL ⊕ ($n = 17$)	
Re-ESWL	–		3		8		7	
Stent	4		5		6		1	
Zeiss	–		2		7		1	
Nephrostomy	–		–		11		5	
Ureteroscopy	–		–		6		1	
Procedures	4		10		38		15	
Patients without procedures	*n*	%	*n*	%	*n*	%	*n*	%
	17	85	9	69	5	24	9	53

Table 5. Auxiliary procedures (P): C_5 stones ($n = 37$ patients)

	AN ($n = 9$)		PL + ESWL ($n = 8$)		ESWL ⊖ ($n = 16$)		ESWL ⊕ ($n = 4$)	
Re-ESWL	–		4		10		2	
Stent	2		5		5		1	
Zeiss	–		2		4		1	
Nephrostomy	–		–		11		2	
Ureteroscopy	–		–		6		–	
Procedures	2		11		36		6	
Patients without procedures	*n*	%	*n*	%	*n*	%	*n*	%
	7	78	3	38	2	13	1	25

Our results are shown in Tables 2 and 3. The number of patients who were stone-free was calculated immediately upon surgery for anatrophic nephrolithotomy and 6 months after the start of therapy for the other procedures. In C_4 stones anatrophic nephrolithotomy yielded very good results. Positive results were also obtained using ESWL monotherapy with preoperatively placed double-J stents. The outcome of a combination of percutaneous litholapaxy plus ESWL was satisfactory as well whereas the course of ESWL monotherapy without stenting was rather poor. In C_5 stones, one has to reckon with lower rates of success. Both anatrophic nephrolithotomy and ESWL with stenting as well as in combination treatment yielded equally good results, whereas ESWL monotherapy proved to be inferior. Because of the small numbers of stones, they were not split up into compound groups; yet no special accumulation was noted.

It seemed to be of interest to compare the additional auxiliary measures that the different procedures called for (Table 4, 5). In these cases anatrophic nephrolithotomy proved to be superior in the treatment of both C_4 and C_5 stones. In ESWL monotherapy, whether carried out with or without stenting, it is known from the beginning that numerous additional sessions as well as a large number of additional auxiliary measures will be necessary. It can also be expected that combination of percutaneous litholapaxy plus ESWL will provide a lower rate of repeated ESWL and fewer additional endoscopic measures.

How long do the different procedures take? The total time needed for ESWL does not figure in Table 6, 7, in which only the effective operating time is calculated. Also under this aspect, anatrophic nephrolithotomy proved to be the most advantageous measure. However, in our opinion, the duration of hospitalisation is more important. As expected, ESWL resulted in the shortest hospital stay, but in most cases the patients are not rendered stone-free and additional sessions must be planned. The combined procedure of percutaneous litholapaxy plus ESWL could possibly be better. On the other hand, anatrophic nephrolithotomy also yielded favourable results.

In the treatment of C_4 and C_5 staghorn stones, there was only a small difference between anatrophic nephrolithotomy, the combination of percutaneous litholapaxy plus ESWL, and ESWL monotherapy with stenting. However, another element should be compared, namely the economic costs that play an important role in today's hospital medicine (Tables 8, 9). One would think that open surgery would be less expensive than the numerous additional sessions and auxiliary measures that ESWL therapy entails. We listed the costs at our clinic, but it should be pointed out that these are not universally valid

Table 6. Average duration of surgery/hospitalisation: C_4 stones ($n = 71$ patients)

	AN	PL + ESWL	ESWL ⊖	ESWL ⊕
Duration of surgery (min)	127	107	–	–
Blood transfusion (ml)	750	450	–	–
Hospitalisation (days)	15.2	16.0	14.6	12.1

Table 7. Average duration of surgery/hospitalisation: C_5 stones ($n = 37$ patients)

	AN	PL + ESWL	ESWL ⊖	ESWL ⊕
Duration of surgery (min)	165	110	–	–
Blood transfusion (ml)	1,266	433	–	–
Hospitalisation (days)	19.4	21.7	15.1	12.0

Table 8. Average costs (sFr): C_4 stones

	AN	PL + ESWL	ESWL ⊖	ESWL ⊕
Operation	6,682	5,478	1,743	1,868
Auxiliary measures	15	447	2,181	1,336
Hospitalisation	5,393	5,817	5,363	4,484
Total patients (sFr)	12,090	11,742	9,287	7,688

Table 9. Average costs (sFr): C_5 stones

	AN	PL + ESWL	ESWL ⊖	ESWL ⊕
Operation	6,682	5,478	1,743	1,868
Auxiliary measures	28	933	4,763	1,719
Hospitalisation	7,272	7,332	5,151	4,000
Total patients (sFr)	13,981	13,742	11,657	7,586

but always depend on local conditions and available funds. If one considers that for methodical reasons X-ray controls and follow-up examinations were not included in these charts, the total sums do not differ too much. However, one should realize that ESWL monotherapy ramains cheaper than any of the other surgical procedures, even when compared with percutaneous litholapaxy.

Our results indicate that anatrophic nephrolithotomy, the combination of percutaneous litholapaxy plus ESWL, and ESWL monotherapy with stenting all yield good results in the treatment of staghorn calculi. We consider it necessary to discuss the approach for treating each staghorn stone with each patient anew (Table 10, 11). On the one hand, an equally favourable outcome in terms of stone-free patients can be achieved in much shorter time and with considerably fewer auxiliary measures using nephrolithotomy. However this procedure involves surgical intervention, with its specific disadvantages. As a result of our not always quite honest propaganda it is, at least for the moment, very much harder to opt for the operative procedure.

On the other hand, we can choose among measures that externally do not show a scar or even a small puncture. However, as our experimental examinations indicate, these may involve a considerable loss of renal parenchyma. Moreover, the follow-up period for passage of the stones is considerably longer. This can be confirmed by any head urologist who, with the same staff, has had to adopt ESWL therapy only because politicians and finance strategists hoped to economize on personnel and costs. Furthermore, this doubtlessly elegant and modern procedure implies a considerable X-ray exposure for the patients. Considering current fears of epidemics and

Table 10. Anatrophic nephrolithotomy

Advantages:	High score of stone-free patients Few auxiliary measures Short period of treatment
Disadvantages:	Open surgery

Table 11. Percutaneous litholapaxy + ESWL

Advantages:	No open surgery Slightly cheaper Satisfactory results (as AN)
Disadvantages:	Frequent auxiliary measures Requires more time increased X-ray exposure Loss of renal, parenchyma as large as in open surgery (?)

Table 12. When open surgery?

Anatomical obstruction:
Infundibular stenosis
Ureteropelvic junction stenosis
Obstructed megaureter
Ostium stenosis
Unsuccessful endoscopic removal (1–2×)
Unsuccessful ESWL therapy
C_5 staghorn calculi

radiation, I am always surprised at how readily patients accept X-ray exposure without discussion. Apparently the media do not presently consider this aspect of radiation exposure to be worthy of mention.

In summary – and in my personal opinion – the following can be stated (Table 12). Open surgery is necessary in cases in which stenoses either hinder the passage of stones or impede an endourological intervention. At endourological failures, one should consider open surgery before the patient or the collecting system refuses to collaborate. The best time to discuss open surgery after unsuccessful ESWL therapy depends on the patient's individual situation and the urologist's surgical experience.

In cases of C_4 staghorn stones, ESWL monotherapy with stenting should be promoted. Within a reasonable time it yields a good outcome in terms of stone-free patients and exposes the latter to as few fatiguing auxiliary measures as possible, all at a justifiable price. However, this treatment modelity requires an appropriate ESWL unit that takes physical laws into consideration and does not place so-called anesthesia-free and out-patient treatment in the foreground. For the treatment of C_5 stones either the combination of percutaneous litholapaxy plus ESWL or anatrophic nephrolithotomy should be given preference.

I believe that in the next few years the opinion will shift back in favour of open operation. For this reason, our colleagues should be encouraged to perform open surgery. If it is not regularly practised today, tommorrow's urologists will not master the technique, which would be a disadvantage for our patients and an advantage for our surgical colleagues.

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