

Overutilisation of Laboratory Services : A Study of Urinary Tract Infection

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ABSTRACT :

Analysis of the case files of 565 patients investigated during March 1985 for the possibility of urinary tract infection revealed that 14.2% of these patients had no clinically justifiable indication for requesting microbial culture and antibiotic sensitivity of the urine neither for diagnosis nor for screening purposes. Analysis of these indications are presented and their clinico-pathological correlation discussed with recommendations for the optimal utilization of the microbiology laboratory services.

The number of laboratory tests performed at the Department of Pathology, Salmaniya Medical Centre (SMC), Ministry of Health, Bahrain has increased tremendously during the last few years¹. These tests were presumably requested for the diagnosis and management of clinical cases as well as for routine screening purposes. Approximately used laboratory facilities undoubtedly strengthen the diagnostic skills of medical practitioners and provide better quality of management. The impression however, within the SMC diagnostic services, is that clinicians are more concerned with quality of care rather than the appropriateness and cost effectiveness of the laboratory investigations, and that some tests are unnecessarily requested. The aim of this work is to study the overutilization of laboratory services at SMC with particular reference to urinary tract infection.

METHODS

The study was based on the review of all of 1568 urine samples belonging to 649 patients, examined during March 1985, at the SMC Microbiology Section, Department of Pathology for routine urinalysis and microbial culture and antibiotic sensitivity. The samples were transported to the laboratory in a sterile disposable containers and those from

children were collected using paediatric collection bags. The samples were inoculated for bacterial count on CLED medium and in cases where the clinical data indicated infections such as gonorrhoea, a special enriched media were also used. Standard methods of bacterial identification and antibiotic sensitivity were used when the culture colony count was 10,000 or more per ml of urine^{2,3,4}. Identification and sensitivity of counts less than 10,000 per ml of urine were only done when the clinical information indicated dysuria, frequency, pyuria, recent urinary tract infection, or when the urine samples was collected by suprapubic aspiration.

At the time of the study the case files of only 565 patients were available for analysis. These were examined for information concerning age, sex, primary disease, clinical department of referral, method of urine collection and appropriateness of the sample, indication and the number of requests to perform urinalysis and bacterial culture during the last 6 months, and the results of routine and microscopic examination, microbial culture and antibiotic sensitivity pattern.

In the tabulation of patients with multiple indications for urine culture certain guidelines were employed. Patients presenting with dysuria and abdominal pain were recorded as dysuria and the column on multiple indications shows the number of patients who had other indications along with dysuria. Similarly patients with renal calculi and pyrexia were listed as pyrexia and the column on multiple indications gives the number of patients who had other indications along with pyrexia.

RESULTS

The source of the 1568 samples examined in this study was as follow : 554 (35.3%) samples from

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patients admitted to SMC, 286 (18.2%) from patients seen at the SMC out patient clinics and 728 (46.2%) from the various health centres on the islands. Nearly one half of the SMC Microbiology resources on urine examination were used for serving the health centres.

Out of the 565 patients whose case files were made available for analysis, 395 (69.9%) had single request for urinalysis, microbial culture, and antibiotic sensitivity carried out during the 6-month period prior to the commencement of the present study, and 170 (30.1%) had more than one request. The clinical department of referral of these patients was as follows : 230 (40.7%) from Obstetrics and Gynaecology, 149 (26.4%) from Surgery, 102 (18.1%) from Internal Medicine, 72 (12.7%) from Paediatrics, and 12 (2.1%) from Accident and Emergency. Voided mid-stream urine samples were collected from 552 (97.7%) patients, and the samples from the remaining 13 (2.3%) patients were collected by catheterization and suprapubic aspiration. Table 1 shows the results of urinalysis, microbial culture, and sex distribution of patients with urinary tract infection. There were 385 (68.1%) females and 180 (31.9%) males. Only 69 (12.2%) patients had positive culture, of whom 48 (69.6%) were females and 21 (30.4%) were males. Specimens

from 401 (71%) patients were sterile, and the remaining 95 (16.8%) patients had mixed growth of 3 or more organisms with insignificant colony count suggesting contamination. Out of the 158 patients with pus cells in the urine (i.e. pyuria) only 35 (22%) had positive culture results.

The underlying conditions in the 101 patients with sterile pyuria (i.e. pus cells in urine associated with sterile urine culture) were as follows : 51 (50.5%) patient with unknown cause, 14 (13.9) with renal calculi, 12 (11.9%) were receiving antibiotics at the time of the study, 7 (6.9%) with recently treated infection, 5 (5%) with glomerulonephritis, 4 (3.9%) had instrumentation of the urinary tract, 4 (3.9%) with prostatic disease, 2 (2%) with urinary tract neoplasm, one (1%) with urethritis and one (1%) with epididymo-orchitis.

The most common indication for requesting urine culture in this study (Table 2) was pregnancy (14.7%) followed by abdominal pain (13.5%), pyrexia (12.2%) and dysuria (10.1%). In the females, the most common indications were pregnancy (21.6%), abdominal pain (13.5%) and dysuria (10.1%). The rate of asymptomatic bacteriuria among pregnant women was 10.8% while that of positive culture in pregnant women with dysuria was 40%. Out of the 76 patients with abdominal pain, only 5 (6.6%) had

TABLE 1

Results of Urinalysis, Microbial Culture, and Sex Distribution of 565 Patients Investigated for Urinary Tract Infection.

Urine Analysis	Positive		Sterile		Contamination		Total	
	No.	%	No.	%	No.	%	No.	%
Pyuria	35	50.7	101	25.2	22	23.2	158	28.0
Normal	25	36.2	259	64.6	65	68.4	349	61.8
Unknown	9	13.1	41	10.2	8	8.4	58	10.2
Total	69	100.0	401	100.0	95	100.0	565	100.0
CULTURE								
Males	21	30.4	126	31.4	33	34.7	180	31.9
Females	48	69.6	275	68.6	62	65.3	385	68.1
Total	69	100.0	401	100.0	95	100.0	565	100.0

TABLE 2

Clinical Indications for Requesting Urine Culture, Sex Distribution, and the Results of Urine Culture of 565 Patients Investigated for Urinary Tract Infection.
(Mlt = Multiple Indications, Psv, Stl, Contam = Positive, Sterile, Contaminated Urine Culture).

<i>Clinical Indication</i>	<i>PATIENTS</i>			<i>Mlt</i>	<i>URINE CULTURE</i>		
	<i>Male</i>	<i>Female</i>	<i>Total</i>		<i>Psv</i>	<i>Stl</i>	<i>Contam</i>
No indication	30	50	80		5	62	13
Dysuria	18	39	57	35	14	34	9
Haematuria	11	1	12	3	3	5	4
Urolithiasis	4	5	9	1	2	6	1
Pyrexia	38	31	69	18	13	43	13
Pregnancy		83	83	26	9	66	8
with dysuria		10	10	6	4	4	2
with small-for-date		8	8			7	1
Pre-eclamptic toxæmia		20	20			18	2
Abdominal pain	24	52	76	18	5	61	10
Pyuria	4	5	9		1	6	2
Urinary surgery	1	2	3			2	1
Instrumentation	6	29	35	2	3	22	10
Previous infection	15	14	29	13	4	20	5
Urine retention	4	4	8	3	3	4	1
Urethral trauma	1		1			1	
Epididymo-orchitis	2		2	1		2	
Cystocel & Ut prolapse		4	4		1	2	1
Proteniuria		5	5			4	1
Frequency	4	1	5	1		5	
Sickle cell disease	2		2			1	1
Threatened abortion		7	7			6	1
Diabetes mellites	3	3	6			5	1
Hypertension		2	2			1	1
Hypospades	2		2			2	
Nonspecific in child	7	2	9			6	3
Incontinence	4	7	11		2	5	4
Congenital anomalies		1	1			1	
TOTAL	180	385	565	127	69	401	95

urinary tract infection and out of the 57 patients with dysuria only 14 (24.6%) had positive urine culture.

Out of the 565 patients surveyed in this study, there were 80 (14.2%) patients with no indication for urine culture. The clinical conditions found in the

case files of these patients were as follows; 13 (16.2%) patients with no clear clinical condition, 4 (5%) with primary infertility, 4 (5%) with dysfunctional uterine bleeding, 3 (3.8%) with vaginal bleeding, 3 (3.8%) with varicocele, 3 (3.8%) with haemorrhoides, 2 each with hydrocele, breast can-

cer, vaginal discharge, Bartholin's abscess, amenorrhoea, jaundice due to Rh incompatibility, normal delivery, chronic obstructive pulmonary disease (20%) and one patient each with undescended testis, atrophic rhinitis, lymphoma of cervical lymph nodes, preoperative thyroidectomy, abscess of the elbow, rheumatic heart disease, breast mass, acute pan-

creatitis, peptic ulcer, irritable hip joint, urticaria, hydatidiform mole, ovarian cyst, haemolytic anaemia, polyp of the cervix uteri, urethral trauma a year ago, cardiomyopathy, post-operative appendectomy, haematemesis, epigastric pain, infection of the labia majora, irregular menstrual period, Fallopian tubal ligation for family planning, pyloric

TABLE 3
Age Distribution and Clinical Indications of Urine Culture in 565 Patients
Investigated for Urinary Tract Infection

<i>Clinical Indication</i>	<i>AGE GROUPS (YEARS)</i>						
	<i>0-5</i>	<i>6-15</i>	<i>16-20</i>	<i>21-30</i>	<i>31-40</i>	<i>41-50</i>	<i>> 51</i>
No indication	11	5	9	29	15	3	8
Dysuria	4	6	6	22	9	5	5
Haematuria	5		2			2	3
Urolithiasis		1		1	1	4	2
Pyrexia	22	12	3	12	10	5	5
Pregnancy			17	52	14		
with dysuria			2	5	3		
with small-for-date				8			
Pre-eclamptic toxæmia			2	15	3		
Abdominal pain	5	11	12	29	10	3	6
Pyuria		1		1	1	2	4
Urinary surgery						2	1
Instrumentation		1	1	12	8	4	9
Previous infection	11	4	1	9			4
Urine retention	1	1					6
Urethral trauma	1						
Epididymo-orchitis				1		1	
Cystocele Ut prolapse				1		3	
Proteinuria		1	1		1		2
Frequency	1	1	1	1			1
Sickle cell disease					1	1	
Threatened abortion			3	3	1		
Diabetes mellites		2				2	2
Hypertension				1		1	
Hypospades	2						
Nonspecific in child	9						
Incontinence	1	2	1	1		1	5
Congenital anomalies	1						
TOTAL	74	48	61	203	77	39	63

stenosis, weight gain, vomiting in an adult, ischaemic heart disease, Hirschprung's disease, rectal prolapse, pleural effusion, frigidity, fracture calcaneum and biliary colic (42.5%).

Table 3 shows the age of patients and the indication for urine culture. There were 122 (21.6%) children below the age of 15 years, 341 (60.4%) patient in the age groups of 16–40 years and 102 (18%) above the age of 41 years. The most common indication in children was pyrexia (27.9%), followed by abdominal pain (13.1%), follow up of previous infection (12.3%), dysuria (8.2%) and non-specific indications (7.4%) such as diarrhoea, excessive crying and failure to thrive. The indications, however, in the age groups between 16–40 years were pregnancy (24.3%), abdominal pain (15%) and dysuria (10.9%); and in those above the age of 40 years were instrumentation of the urinary tract (12.8%), prostatic disease (10.8%), abdominal pain (8.8%) and renal stones (5.9%).

During the period of the present study, there were 48 (8.5%) patients who were receiving antibiotic therapy either for current infection or for unknown reasons.

DISCUSSION

Laboratory investigations are indicated for screening of diseases and to confirm or exclude a particular clinical condition. Many tests, however, are unjustifiably prescribed and these should be kept to the minimum, because the cost of health care is directly related to the number and type of laboratory tests done on the patient⁵. Furthermore the increased work load on the laboratory have an adverse effect on the quality of laboratory performance. In this study, 14.2% of the patients investigated for the possibility of urinary tract infection had no signs and symptoms suggestive of this condition and had no primary disease to justify urine culture as a routine screening procedure. The clinical circumstances which need to be considered in this connection are discussed below.

Dysuria :

Acute dysuria in women results most commonly from 3 conditions : vaginitis, cystitis, or acute urethral syndrome. In this study 24.6% of the patients with dysuria had positive urine culture and the rate among pregnant women with dysuria was

40%. Demetriou et al.⁶ pointed out that the majority of cases of vaginitis and other gynaecological infection in adolescent girls results in dysuria, a symptom associated with urinary tract infection. This emphasizes the need of careful gynaecological evaluation before deciding on the appropriate laboratory tests. The main agents responsible for dysuria are *N gonorrhoea*, *Chlamydia Trachomatis*, *H influenzae*, and low count bacteriuria^{6,7,8}. The aspects which need to be considered in the diagnosis of these infections are discussed below.

Pregnancy :

The incidence of bacteriuria in pregnancy varies from 4 to 6.9%^{9,10,11} and in the present study it is 10.8%. The major problem in the diagnosis of asymptomatic bacteriuria in pregnancy is proper collection of urine specimens. For the specimens to have diagnostic validity, the perineum should be cleaned thoroughly and the patient instructed on the technique of proper collection. Accurate diagnosis of infection is very important during pregnancy because the choice of antibiotics is limited and if left untreated, the infection may lead to eclampsia and toxemia of pregnancy, pyelonephritis, and foetal prematurity^{9,10,11}.

Abdominal Pain :

Out of the 76 patients with abdominal pain investigated in this study for urinary tract infection, 58 (76.3%) had no indication (e.g. renal stones, fever, haematuria, history of urinary tract infection) for urine culture and antibiotic sensitivity, and only 6.6% of the patients had positive urine cultures. According to various published reports the incidence of asymptomatic bacteriuria in normal women of childbearing age is 4–6% increasing thereafter by 1–2% per decade¹². There is therefore no difference in the incidence of bacteriuria between normal population and the patients investigated for abdominal pain in this study. This indicates that the cause of abdominal pain in these patients was not urinary tract infection and that the requests for urine culture were unnecessary.

Pyrexia :

When signs and symptoms of infection elsewhere in the body (e.g. respiratory tract) are absent, urine culture are indicated for the diagnosis of unexplained fever. In this study 18.8% of the patients with fever had positive urine culture. This is one of

the situations where urine cultures are justifiable for both diagnosis and exclusion.

PYURIA

Pyuria is not a reliable indicator of urinary tract infection¹³. In this study 22% of the patients with pyuria had positive urine culture. Pyuria is also known to occur in association with many other conditions. Childhood pyuria in the absence of urinary tract infection is known to occur following viral immunization¹⁴ and in association with gastroenteritis¹⁵. In addition, pyuria may continue for several days after successful treatment of urinary tract infection.

OTHER INDICATIONS

Other justifiable indications for urine culture are non-specific signs and symptoms in the neonates such as weight loss, cyanosis, and irritability. Other indications in children and in adults include follow up of recent urinary infection and following instrumentation of the urinary tract. However, the routine follow up of urine cultures is unnecessary in asymptomatic adult, non-pregnant women and in non-diabetic patients with no urological disorder. Therapy is also unnecessary in these asymptomatic cases⁵.

APPROPRIATENESS OF THE SPECIMEN

Urine samples from 97.7% of the patients in this study were voided mid-stream specimens, out of whom 16.8% had mixed growth of 3 or more organisms of insignificant colony count suggesting contamination. Unreliable urine collection can therefore result in unreliable culture data. To avoid misleading culture results and to obtain reliable laboratory diagnostic data, it is essential to instruct the patient on the proper methods of collection of mid-stream urine sample. In infants and young children, suprapubic aspiration is the most reliable method of collection. Samples collected by strap-on bags may also be used and when these show culture result, a further confirmatory sample collected by suprapubic aspiration is needed before starting antibiotic therapy. Suprapubic aspiration is also recommended for the detection of bacteriuria caused by organisms with low colony count.

Another important consideration in the appropriateness of specimen is the collection of urine

sample before the institution of antibiotic therapy. In this study, the specimens from 48 (8.5%) patients were found inappropriate because the patients were already on antibiotic treatment when the urine samples were collected.

CLINICAL INFORMATION

Normally, cultures from voided urine specimens are not routinely processed in search of organisms with colony count less than 10,000 per ml of urine. However, urinary tract infection has been reported to occur with organisms in low concentration¹² and it is therefore essential for the laboratory to be informed about the clinical details of the patients in order to determine how far to carry the identification and antibiotic sensitivity tests. Clinical details are also important to decide on the type of culture media especially for the isolation of such fastidious organisms as *N gonorrhoea* and *H influenzae*.

HEALTH CARE COST

It has been estimated that two thirds of the expenses involved in the treatment of uncomplicated cystitis are spent on laboratory services and that the remaining third are spent on medication and physician charges⁵. Since 14.2% of the patients investigated in this study had no clinically justifiable indication for requesting urine culture and antibiotic sensitivity, one would expect that the cost of this overutilisation is very high.

CONCLUSION

Careful consideration of all the aspects of diagnosis and management of urinary tract infection is necessary to eliminate unnecessary laboratory tests, and reduce health care costs without jeopardizing the clinical care.

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