

Renal Impairment in the Surgical Patients of Peritonitis

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ABSTRACT

Background: Perioperative renal impairment is a leading cause of morbidity and mortality in surgical patients. In these patients renal involvement is mainly acute kidney injury (AKI). AKI is more common in surgical patients of peritonitis due to sepsis and hypovolemia. AKI is usually diagnosed by rise in serum creatinine value and fall in urine output. But there are also other parameters to be observed in AKI. Risk of AKI is more in the presence of other Co-morbidities and it also depends on the type of surgery, mainly major surgeries and emergency surgeries in the presence of peritonitis. **Objective:** The main objective of this study is to know the causes and risk factors for AKI in surgical patients of peritonitis and to study the diagnosis and treatment of AKI as well as peritonitis. **Methods:** 200 patients of peritonitis due to various causes admitted to the Surgery Wards of VIMSAR Hospital Burla, Odisha, India who had features of impaired renal function (AKI) were studied over a period 1 year from march 2019 to march 2020. **Results:** Renal impairment was mostly seen in peritonitis patients having generalised peritonitis, severe sepsis, hypovolemia and hypotension. Most of the patients improved after surgical intervention, treatment of sepsis by antibiotic and correction of hypovolemia and hypotension. Few patients did not improve by these methods and required dialysis. **Conclusion:** Early treatment should be started in every cases of peritonitis to prevent AKI. When AKI develops timely intervention should be done to prevent further renal damage.

Keywords: Acute kidney injury, Peritonitis, Renal impairment, Surgical patient.

INTRODUCTION

Peritonitis is inflammation of peritoneum. It may be spontaneous bacterial peritonitis or it may be secondary peritonitis, usually due to spread of infection from GI tract.

Common causes of peritonitis in surgical patients are:-

- Appendicular perforation
- Perforated gastric and duodenal ulcer.
- Diverticulitis
- Pancreatitis
- Cholecystitis
- Pelvic inflammatory disease.
- Crohn's disease
- Stab injury or blunt injury abdomen

Besides the clinical features of the primary disease, any case of secondary peritonitis present with pain abdomen and on examination there is abdominal guarding and rigidity. In any case of peritonitis the primary cause or the source of infection should be searched and treated accordingly.

If not treated promptly peritonitis can lead to septicaemia and multiorgan dysfunction syndrome (MODS). Kidney is one of the organs involved in MODS. Though peritonitis is a very common

problem in surgical practice no study has been done to know the pattern of involvement of kidney in peritonitis in surgical patients. This study has been conducted to know the pattern of renal involvement in secondary peritonitis.

It will help in the prevention, early detection and management of AKI to prevent further renal damage.

MATERIALS AND METHODS

This prospective study was conducted on patients with peritonitis admitted to the Surgical Wards of VIMSAR Burla Hospital who have features of AKI. The study period was one year from March 2019 to March 2020. Number of patients included in this study was 200.

Inclusion Criteria:

1. Patients presenting with peritonitis and features of renal impairment.
2. Either sex
3. Age more than 14 yrs.

Exclusion Criteria:

1. Peritonitis due to medical cause
2. Age < 14 years

Procedure Methodology:

After written informed consent was obtained and after ethical clearance a well-designed questionnaire was used to collect the data.

After thorough clinical examination all the patients were investigated by laboratory tests and straight

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abdominal X-ray. USG and CT scan was done when indicated. The laboratory tests done were – CBC, Sr urea, Creatinine, Sr.Sodium, Potassium, Calcium, Phosphorus , Bicarbonate, S. uric acid, Sr. total protein & albumin, blood sugar and urine routine and microscopic test. After proper resuscitation patients were operated and post-operative observation was also made. AKI was managed with antibiotics, fluid and electrolyte management and dialysis when indicated.

Statistical Analysis:

The detailed history, clinical features, laboratory and radiological findings and operation notes were recorded in proforma prescribed for each case. Subsequently data were compiled for statistical analysis.

RESULTS

Age and Sex Distribution:

Table 1: Age and Sex distribution of surgical patients of peritonitis with renal impairment.

Age group (years)	No. of male patients (percentage)	No. of female patients (percentage)	Total (percentage)
14-20	3 (1.5%)	1(0.5%)	4 (2%)
21-30	7 (3.5 %)	4 (2 %)	11 (5.5 %)
31-40	18 (9 %)	12 (6%)	30 (15%)
41-50	21 (10.5%)	14 (7 %)	35 (17.5 %)
51-60	28 (14 %)	16 (8 %)	44 (22 %)
61-70	34 (17 %)	22 (11 %)	56 (28 %)
>70	15 (7.5%)	5 (2.5%)	20 (10%)
Total	126 (63 %)	74 (37 %)	200 (100%)

During the period of one year of our study total 410 patients of peritonitis due to various causes were admitted to the Surgical Wards of VIMSR Burla. Out of them 200 (48%) patients have features of renal impairment (AKI).

Table 2: Clinical Features

Symptoms and Signs	No of cases	Percentage
Pain Abdomen	200	100 %
Vomiting	113	56.5 %
Fever	162	81 %
Decreased urine output	124	62 %
Abdominal Tenderness	200	100 %
Guarding & Rigidity	200	100 %
Free Fluid	180	90 %
Obliteration of liver dullness	128	64 %
Absent bowel sound	191	95 %

When looking into the age & sex distribution [Table 1] the most common age group affected are between 61-70 yrs followed by the age group 51-60yrs. In these age groups renal impairment is more commonly seen because these patients are also having other co-morbidities like diabetes, hypertension, cardiac problems, malignancy etc. So these patients may be having pre-existing renal problems to some extent which are aggravated after having the surgical pathology and peritonitis.

In our study 22 (11 %) patients had diabetes, 60 (30%) patients had hypertension, 6 (3%) patients had cardiac problem, 10 (5%) patients had malignancy and 30 (15%) patients had previous history of chronic kidney disease (CKD).

[Table 2] shows the clinical features of patients of peritonitis with renal impairment. All the patients presented with pain abdomen and all patients had abdominal guarding and rigidity due to inflammation of parietal peritoneum. Though renal impairment was there, urine output decreased in only 124 patients (62%). Hollow viscus perforation was seen in all the patients. But clinically pneumoperitoneum as observed by obliteration of liver dullness, was found in only 128 patients (64 %).

Table 3: Laboratory findings and X-ray features of surgical patients of peritonitis with renal impairment.

Laboratory Findings	No of cases	Percentage
TLC >11000/Cumm	200	100 %
Hb < 10gm %dl	98	49%
Sr. Urea – 40-80 mg/dl	84	42 %
81-150 mg/dl	76	38 %
>150 mg/dl	40	20 %
Sr. Creatinine – 1.4 -2.0 mg/dl	91	45.5 %
– 4.0 mg/dl	73	36.5 %
>4.0 mg/dl	38	19%
Low Sr. Sodium (Hyponatremia)	50	25 %
High Sr. Potassium (Hyperkalemia)	120	60 %
High Sr. Phosphorus (Hyperphosphatemia)	62	31 %
Low Sr. Calcium (Hypocalcemia)	140	70 %
High Sr. Uric Acid (Hyperuricemia)	128	64 %
Low total Sr. Protein & albumin	184	92 %
Urine RE/ME – Protein	50	25 %
Epithelial cast	80	40 %
Hyaline Cast	118	59 %
Granular cast	72	36%
Pus cell	48	24 %
X-ray(Straight Xray abdomen)	No of cases	Percentage
Pneumoperitoneum	136	68 %

[Table 3] shows the laboratory findings and X-ray features of surgical patients of peritonitis with renal impairment. Leucocytosis (TLC>11000/cumm) was found in 100% Mild elevation of Sr urea (40-80 mg/dl) was found in 42 % of patient. Very high level, >150 mg/dl was found in only 20 % of patients. Similarly mild rise in Sr. Creatinine (1.4 – 2 mg/dl) was found in 45.5 % of patients and high level was found in 19 % of patients. In electrolytes hyperkalemia (Sr. K+ >5.0 mmol/l) was more common (60 %) than hyponatremia (Sr Na+ < 135 mmol/l) (25 %). Low serum total protein and albumin was found in most of the patients (92 %). In routine and microscopic examination of urine, proteinuria (25 %) epithelial cast (40 %), Hyaline cast 59 %, granular cast 36 % and pus cells found 24 % of patients.

Though all patients were having Hollow viscus perforation, in x-ray free peritoneal gas (pneumoperitoneum) was seen in only 68% of cases. This is because in all the cases of gastric, duodenal, jejunal & ileal perforation we do not get free in x-ray. In appendicular perforation the free gas is so minimal in amount that it is not visible in x-ray.

Besides these investigations, Ultrasonography (USG) was done in some cases. Mainly appendicular perforations were diagnosed by USG. In AKI there was no specific USG findings in kidney. In patients having previous history of CKD features of medical renal disease may be seen in USG.

Table 4: Causes of peritonitis and surgical procedures done in surgical patients of peritonitis with renal impairment.

Cause of peritonitis	Surgical procedure done	No of patients	Percentage
Gastric perforation	Biopsy taken from ulcer margin. Closure of perforation with omental patch and peritoneal lavage.	28	14
Duodenal perforation	Closure of perforation with omental patch and peritoneal lavage	88	44
Jejunal perforation	Closure of perforation in two layer	16	8
Ileal perforation	-Closure of perforation in two layer -Resection & anastomosis when indicated , - Ileostomy in some cases	28	14
Appendicular perforation	-Appendectomy	30	15
Anastomotic leakage	-Colostomy -Ileostomy -Peritoneal leakage	10	5



Figure 1: X-ray showing free gas under right dome of diaphragm

[Table 4] shows the causes of peritonitis in the surgical patients included in our study group and the surgical procedure done in them. All the patients had some form of Hollow viscus perforation. Duodenal perforation was the most common cause and anastomotic leakage was the least common cause.

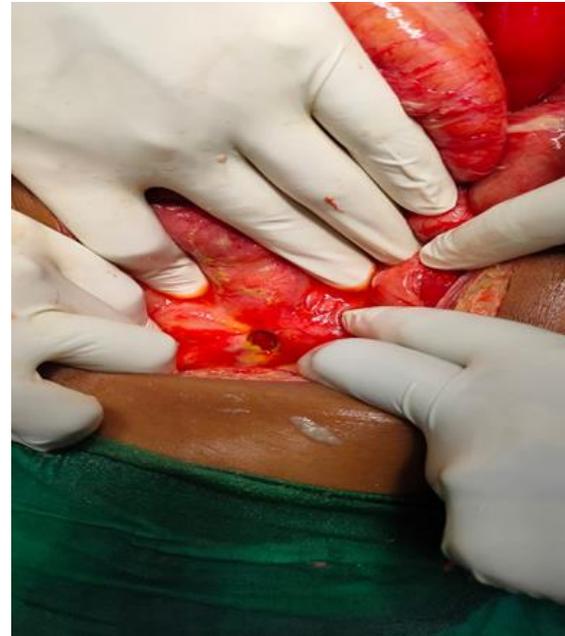


Figure 2: Gastric perforation



Figure 3: Ileal Perforation

Most of the patients recovered after surgery due to the removal of septic focus, proper antibiotic therapy and fluid and electrolyte management.

Renal function did not improve in 15 patients of peritonitis even after operation as seen by rising Sr urea & creatinine value & decreased urine output. All these patients were subjected for haemodialysis. After haemodialysis, 13 patients improved gradually to recover from AKI. Rest of the two patients did not improve & died even after dialysis. These two patients had previous history of CKD & diabetes. One had gastric perforation and another had anastomotic leak in which colostomy had been done. Both were of >70 yrs of age.

In post-operative complication wound dehiscence and pulmonary complication were more significant. Post-operative wound dehiscence healed after secondary suturing and pulmonary complication improved after proper antibiotics, chest physiotherapy and nebulisation.

DISCUSSION

Peritonitis is inevitable after any Hollow viscus perforation. It may be biliary peritonitis after gastric or duodenal perforation and faecal peritonitis after ileal or colonic perforation. But ultimately leads to bacterial peritonitis and pyoperitoneum in any case. If not treated properly it may lead to septicaemia and death. Peritonitis affects many other organs due to sepsis. Kidney is one of them. Peritonitis in surgical patients when associated with renal impairment (AKI) it increases the morbidity and mortality to many folds. According to Charles Hobson et al AKI is found in up to 50 % of surgical patients. In our study of 200 patients of peritonitis with renal impairment it constitutes 48 % of surgical patients.

Risk Factors:

There are some risk factors for development of AKI in Surgical patients of peritonitis or any surgical patients.^[18] In our study most of the patients were between the age group from 61 to 70 yrs and male patients predominates female patients. So male sex and increasing age are risk factors for development of AKI. Others risk factors & causes for AKI as seen in our study are, infection (as detected from leucocytosis), hypotension, hypovolemia and associated co-morbidities like diabetes, hypertension, malignancy and previous history of CKD. When associated with these co-morbidities the recovery time is delayed. Literature of Goren & Motal also supports these facts.^[1]

According to Grams et al,^[5] as per their study of 161,185 patients cardiac surgery presented the greatest risk for AKI. In our study peritonitis due to duodenal perforation has maximum number of patients and so greatest risk for AKI.

Definition & Diagnosis of AKI:

According to Goren and Matot^[1] the term AKI is used to describe deterioration (hours to days) of renal function. It is diagnosed by reduction in urine output (even after correction of hypovolemia) and increase in the serum creatinine value. It has many limitations, such as a delay in diagnosing early stage of AKI. Research into the efficiency of novel biologic markers is going on to improve the identification and treatment of AKI.

Pathophysiology of Renal impairment in Surgical Patients – Historically AKI was categorised into – Prerenal.^[2]

- Renal
- Post renal

Prerenal – Prerenal AKI is a functional response to renal hypoperfusion where intrinsic renal tubular function remains intact. It results from hypovolemia and low cardiac output.

Renal – It results from the disease process of the renal vasculature, glomeruli, tubules or interstitium.

Post-renal – It is caused by a blockage of the urinary flow in the urinary tract, inducing a backup in to the kidney and hydronephrosis. There is no inherent renal disease. So renal function returns if obstruction is relieved.

Prolonged prerenal AKI if not treated can lead to secondary acute tubular necrosis (ATN). In addition systemic inflammation and cytokine release caused by trauma and surgical stress directly induce tubular injury. Renal auto regulation can also be disrupted by using nonsteroidal anti-inflammatory drugs during perioperative period.

Prevention of AKI in surgical patients of peritonitis

- Identify patients at risk
- Correction of anaemia
- Balanced crystalloid solutions are superior to chloride rich solution.
- Avoid use of diuretics unless there is volume overload.
- Avoid unnecessary blood transfusion.
- Avoid nephrotoxic drugs. Avoid low MAP even for a short period of time.

Treatment:

- **Resuscitation of the patients:** In our study all the patients were adequately resuscitated before surgery by giving antibiotics, proper IV fluid and pre-op blood transfusion when indicated. In this method circulatory volume is maintained to improve renal perfusions. When blood pressure did not improve after adequate fluid therapy vasopressors like Dopamine and Nor-adrenaline were used.
- **Surgical intervention :** In every case surgical intervention was done to remove the infective focus and to correct the surgical pathology.
- **Pharmacological agents:** We did not use any specific pharmacological agent to prevent or treat AKI in our study because though pharmacological intervention to effectively treat and prevent AKI have been evaluated extensively, current evidence does not support the role of N-acetyl cysteine or supplements such as Selenium, Zinc, Vitamin C, E and B to prevent AKI.^[9,10] Dexmedetomidine, a selective alpha 2 adrenergic receptor agonist may have the capacity to attenuate AKI in surgical patients. However further studies are required to use it clinically.^[11]
- **Renal replacement therapy :** According to Sam D Gumbert et al renal replacement therapy is the only therapy for AKI to date. The Kidney Disease Improving Global Outcomes Criteria advocate initiating renal replacement therapy when fluid

accumulation becomes life –threatening or major imbalance (e.g. acidosis, electrolyte abnormalities and uremia) occurs. However there are many debates on this.^[13,14]

- **Fluid replacement** : Administration of fluid is a mainstay of therapy to prevent hypovolemia and improve renal perfusion. However there should not be fluid overload. The most frequently used isotonic crystalloid is 0.9 % sodium chloride.^[15,16]
- **Others** : Avoidance of nephrotoxic drugs, glycemic control and nutritional supports are equally important.^[17]

CONCLUSION

Preoperative organ injury is among the leading causes of morbidity and mortality of surgical patients. Renal impairment occurs particularly frequently in surgical patients of peritonitis and has an exceptionally detrimental effect on surgical outcome. Currently AKI is mostly diagnosed by increase in serum creatinine concentration or decreased urine output. The search for earlier and more specific biomarkers is an area of intense research. The risk factors for development of AKI in surgical patients of peritonitis as we found in our study are – male sex, increasing age, diabetes mellitus, hypertension, previous CKD and malignancy. When these risk factors are present we should be more careful to prevent & manage AKI in surgical patients. Nephrotoxic drugs should be avoided in these patients. Every case of peritonitis should be treated with antibiotics, and adequate fluid replacement should be done as early as possible to prevent renal impairment from sepsis and hypovolemia. Timely surgical intervention should be done to remove the septic foci, correction of surgical pathology and to prevent further kidney damage from septicaemia. In the post- operative period fluid & electrolyte balance should be managed properly. When there is no improvement of renal function with these measures dialysis can be done. Renal function usually improves after this and there is less chances of progression to CKD in previously normal patient.

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