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Anaesthesia and typhiod perforation: an anaesthetist's experience

IK Kolawole

Department of Anaesthesia, University of Ilorin Teaching Hospital, Ilorin, Nigeria

Summary

The acceptance of surgery as the best hope of survival in patients with typhoid perforation has greatly increased the role of the anaesthetist in the management of these patients. The purpose of this study was to review our anaesthetic experience in the management of patients with typhoid perforation over a period of 10years (January 1988 – December 1997). Ninety-five patients aged between 3 and 70 years were anaesthetized for surgery on account of typhoid perforation within the study period. More than three-quarter of them (78%) were in the ASA classification 3 and 4. All the patients had general anaesthesia with endotracheal intubation. Preoperative adverse events were recorded in 30 patients (31.6%) and mortality rate was 18.95%. Severe dehydration and ASA=4 were preoperative factors of statistical prognostic importance (P=0.03 and 0.00 respectively). We conclude that even though patients with typhoid perforation usually present in poor clinical state with high anaesthetic risk, a well conducted anaesthesia preceded by adequate resuscitation, still offers a good hope for fairly good surgical outcome. Anaesthetic management must ensure adequate oxygenation and perio-operative haemodynamic stability.

Keyword: *Typhoid, perforation, anaesthesia.*

Résumé

L'acceptance la chjiragie comme la malleur option pour la survie des patient avec peforations intestinales due a la fievre typhoid a graudement augmente le role de l'anaesthesiste dans la traitement de ces patient. Le but de cette etude genmdant une periode de 10 ans etait de nevoir notre experience anesthetique dans le traitment des patients ayant des perforations intestirales due a la fievre typhopid (Janvier 1988 a Decembre 1997). Durant cette periode, quatrent vingt quinze patients ages de 3 a 70 ans etaient anaesthesies pour chiregie; a plus de ∫ des patient 78% etaient dans les classification ASA 3 et 4. Tous les patients recu un anaesthetic avec l'intubation endotracheale. Les effects adverse avant l'operation etaient enregistres chez 30 patients (31.6%) et un taux de mortalite de 18.95. Une dehydration severe et ASA ≥ 4 etaient les faiteurs statistique prognostique de l'avant operation (P = 0.03 et 0.00 respectivement). Nous avons conclu que, bienque les patients ayants les perforations typhoidiques ont une manvoure conditions clniques avec des risques eleves du anaesthesia. Une bonne anaesthesie precede d'une resucitation adequate, offer un grand espir pour une bonne chirugie. Le management anaesthetique doit veille a une oxygenation adequate et une stabilite hemodynamoque diant l'operation.

Introduction

Anaesthetists may become involved in the management of typhoid fever either in anaesthetizing the patient for surgery or in the intensive care of the complications. The growing acceptance of surgery as the best hope for survival in patients with typhoid perforation [1-4] has greatly magnified the relevance of the anaesthetist in the care of these patients. Typhoid fever is a systemic disease with varying degrees of systemic manifestations and multiple organ involvement/compromise. Furthermore, as the disease affects, particularly, people in the low socio-economic group, patients are often already debilitated and generally in poor state of health [5]. Providing anaesthetic care for these patients who are often septic with massive apparent fluid loss is one of the challenges an anaesthetist practising in this environment must be prepared to face. Fortunately, despite the initial gloomy picture, the outcome of surgery in typhoid perforation has greatly improved [3,4]. This is due to the recent advances in surgery and anaesthetic techniques. However, while several reports have appeared in the journals on the surgical aspect of typhoid perforation, the author is unaware of any specifically on the anaesthetic management of these patients.

The purpose of this retrospective study was to review our anaesthetic experience in the care of patients with typhoid perforation in our center

Materials and methods

The case notes and anaesthetic records of all patients who had surgical operation on account of typhoid perforation at the University of Ilorin Teaching Hospital (UITH) between January 1988 and December 1997 were reviewed. Only those cases surgically confirmed at laparotomy were included in the study.

The information extracted included demographic characteristics, pre-operative status, anaesthetic management, perio-operative course and final outcome. These were manually entered into proforma and subsequently analysed using EPI-INFO version 6.02 software.

Results

Patients characteristics:

A total of 95 patients with typhoid perforation were anaesthetized for surgical operation during the study period. There were 60 males (63.2%) and 35 females (36.84%), giving a male:female ratio of 1.7:1 (Table 1). Their ages ranged between 3 and 70 years with a mean age of 18.56±12.9 years.

Table 1: Age/sex distribution of patients with typhoid perforation (1988-1977)

Age	Male	Female	Total
1-4	3	2	5
5-9	9	9	18
10-14	15	13	28
15-19	8	2	10
20-24	6	6	12
25-29	6	1	7
30-34	5	1	6
35-39	3	-	3
40-44	2	-	2
45-49	1	-	1
50-54	1	-	1
55-59	-	-	-
60-64	-	-	-
65-69	-	1	1
70-74	1	-	1
Total	60	35	95

Correspondence: Dr. I.K. Kolawole, Department of Anaesthesia, Universityof Ilorin Teaching Hospital, Ilorin, Nigeria.

Fifty-one (53.68%) of the patients were in the paediatric age group (0 –14 years), while only 6(6.32%) were aged 40 years and above. The peak age group was 10-14 years which constituted 29.47% of the total.

Pre-operative assessment:
Categorising according to the American Society of Anaesthesiologists (ASA) classification of physical status is on Table 2. The systemic disturbances or associated complications are shown in Table 3. They included anaemia with PCV less than 30% in 29 patients (30.52%), pneumona in 8 patients (8.42%), jaundice and typhoid psychosis in 6 patients (6.32%) each and peripheral circulatory failure in 16 patients (16.84%). Table 4 shows the hydration status on admission. Most of the patients, 72 (75.8%), had mild to moderate dehydration, while 21 patients (22.1%) had severe dehydration. The two patients who had normal hydration status had been to other hospitals where they were rehydrated before referral to UITH.

Table 2: ASA vs mortality in patients with typhoid perforation (1988-1997)

ASA	No. of Cases	Mortality	P-value
1	-	-	-
2	8	-	0.1188
3	29	2 (11.11%)	0.0000
4	46	10 (55.6%)	0.1783
5	12	6 (33.3%)	-
Total	95	18	-

Table 3: Pre-operative complications/Associated Medical conditions vs Mortality in patients with typhoid perforation (1988-1977)

	No. of patients	Mortality (%)	P-value
1. Anaemia	27	5(27.8%)	0.265
2. Peripheral circulatory failure	16	5(27.8%)	0.553
3. Lobar/broncho-pneumonia	6	2(11.1%)	0.649
4. Jaundice	6	3(16.7%)	0.593
5. Typhoid psychosis	6	2(11.1%)	0.649
6. Pneumonia + anaemia	2	1(5.5%)	-
7. Chronic obstructive pulmonary disease	1	-	-
8. Chronic osteomyelitis	1	-	-
9. Malnutrition	1	-	-
Total no. of patients	95	18	-

Laboratory Investigations:
Preoperative laboratory results were not available at all in 15 patients (15.79%) while it was incomplete in 59 patients (62.1%). Table 5 shows the serum biochemistry results. Hyponatraemia, occurring in 58 patients (61.05%), was the commonest biochemical derangement. This was followed by raised urea level in 42 patients (44.21%) and hypokalaemia in 11 patients (11.58%).

Table 4: Hydration status vs mortality in patients with typhoid perforation (1988-1997)

Status	No. of Cases	Mortality	P-value
Normal hydration	2	-	-
Mild dehydration	30	6(3.33%)	0.1102
Moderate dehydration	42	5(27.8%)	0.6567
Severe dehydration	21	7(38.9%)	0.03
Total	95	18	-

Table 5: Pattern of serum Biochemistry in patients with typhoid perforation (1988-1997)

Sodium	No. of cases
Normal value	21 (22.11%)
Hyponatraemia	58 (61.02%)
Hypernatraemia	1 (1.02%)
Result not available	15 (15.79%)
Total	95
Potassium	
Normal value	68 (71.55%)
Hypokalaemia	11 (11.58%)
Hypekalaemia	2 (2.11%)
Result not availabe	14 (14.74%)
Total	95
Urea	
Normal value	37 (38.95%)
Raised urea	42 (44.21%)
Result not available	16 (16.84%)
Total	95
Creatinine	
Normal value	6 (6.32%)
Raised level	15 (15.79%)
Result not available	74 (77.89%)
Total	95
Bicarbonate	
Normal value	3 (3.16%)
Raised level (alkalosis)	-
Low level (acidosis)	7 (7.37%)
Result not available	85 (89.47%)
Total	95

Of the 21 patients (22.11%) whose serum creatinine level were documented, 15 patients (15.79%), 7 adults and 8 children, had elevated values (greater than 106 mmol/L and 62mmol/L in adults and paediatrics respectively). Also, of the 10 patients (10.53%) with documented serum bicarbonate, 7(7.3%) 4 adults and 3 children, had low serum values (< 20mmol/L). The packed cell volume (PCV) ranged between 11% and 50% with a mean of 33.20 ± 13.4%.

Technique of anaesthesia:
All the patients had general anaesthesia with endotracheal intubation. Anaesthesia was induced with thiopentone in 62 patients(65.26%), while ketamine was used in 33 patients (34.74%) with poor cardiovascular status. Tracheal intubation was facilitated with suxamethonium in all cases. Anaesthesia was

maintained with nitrous oxide and oxygen 50:50, supplemented with varying concentrations of halothane in a balanced anaesthetic technique. Pancuronium was employed to maintain muscle paralysis and ventilation was by manual intermittent positive pressure ventilation (IPPV). Intravenous pethidine or pentazocine was used to supplement analgesia. Perio-operative monitoring including pulse rate, non-invasive blood pressure measurements, and hourly urine output recording. Twenty-five patients (27.0%) required intra-operative blood transfusion.

Peri-operative course:

Sixty-five patients (68.42%) tolerated anaesthesia well with recovery from anaesthesia largely uneventful. Peri-operative adverse events (from anaesthesia induction till discharge from recovery room), were recorded in 30(31.6%), most of whom (80%) were in ASA 4 and 5 (Table 6). Only one patient in ASA II suffered peri-operative adverse event (hypotension). Two patients in ASA IV died of irreversible cardiac arrest intra-operatively while one in ASA V died of irreversible shock in the recovery room. One of the patients who suffered immediate post operative respiratory depression was transferred to the intensive care unit (ICU) for further oxygen therapy and vital signs observation, but died from respiratory failure within 24 hours. The patient needed respiratory support but could not be provided because there was no functional ventilator in our ICU at the time. Four other patients, two of whom were of ASA V physical status, died within 24 hours in the ward. The remaining 10 post-operative deaths occurred at various periods after 24 hours in the ward giving an overall mortality rate of 18.95%. Severe dehydration and ASA= 4 were preoperative factors of statistical prognostic significance ($P = 0.03$ and 0.00 respectively).

Table 6: Perioperative adverse events vs ASA in patients with typhoid perforation (1988-1997)

Types	ASA					No. of patients
	1	2	3	4	5	
1. Hypotension	-	1	3	12	8	24
2. Death	-	-	2	3	3	8
3. Delayed recovery	-	-	-	2	4	6
4. Respiratory depression	-	-	-	1	3	4
5. Oliguria	-	-	-	-	2	2
6. Bronchospasm	-	-	-	-	-	1

Discussion

The anaesthetic management of patients with typhoid perforation presents several challenges. Thus the anaesthetist must be prepared to: (a) deal with the problems of fluid and electroylyte imbalance; (b) prevent regurgitation and aspiration under anaesthesia (c) ensure intraoperative haemodynamic stability, and (d) ensure adequate tissue perfusion and oxygen delivery in the face of increased oxygen demand due to sepsis and some abnormality in gaseous exchange resulting from associated chest infections, as seen in some of our patients. In order to accomplish these, our anaesthetic management usually begins with a careful assessment of the physical status of the patients and laboratory evaluation to assess the extent of systemic disturbance and organ compromise.

The significant fluid and electrolyte derangements observed in this study is in agreement with previous reports [5-8]. This has been attributed to impaired intestinal absorption associated with ileus, and exudative losses to the peritoneal cavity [5]. The average preoperative fluid requirement in an adult patient with typhoid perforation has been estimated to be about 4.0 litres [5]. However, the degree of volume deficit largely depends on the duration of the disease process. Although most of our patients (75.8%) were admitted with mild to moderate degree of dehydration, a sizeable number (16.8%), also had intravascular volume deficit severe enough to cause peripheral circulatory failure (Table III). This is not surprising because the generalized increase in microvascular permeability associated with sepsis may, in severe cases, result in further decrease in intravascular volume. Whatever the degree of dehydration prompt and adequate replacement of fluid deficits and correction of electrolyte imbalance have been emphasized as the key to patient's survival in typhoid perforation [5,6,9]. Although complete restoration of circulatory volume was not possible because of on-going sepsis, enough fluid therapy was ensured in our patients before anaesthesia to enhance intraoperative haemodynamic stability. Inspite of this, however, 33.33% of those who were admitted with severe degree of dehydration still died in the post-operative period. This constituted a statistically significant fraction of the overall mortality in our series ($P = 0.03$), which may have been as a result of the magnitude of the systemic disturbance and organ compromise associated with this degree of fluid deficit. Furthermore, it must also be realized that the circulatory depression in these septic patients is often confounded by a reduced vascular tone mediated through induced nitric oxide production, which might be associated with myocardial dysfunction [10]. These changes may result in a fall in cardiac output, profound hypertension and poor organ perfusion with multiple organ failure and death [11].

We have found the use of isotonic saline for pre-operative rehydration effective in correcting the sodium deficits in these patients, while potassium infusion is used to correct the hypokalaemia. The need for pre-operative correction of hypokalaemia in typhoid perforation as a precondition for good surgical outcome was recognized by Badoe several decades ago [12]. Uncorrected hypokalaemia predisposes to cardiac arrythmias and makes the patient more sensitive to the effects of muscle relaxants [13]. The high incidence of pre-operative anaemia in our series is also in conformity with previous studies [3,5]. This is hardly surprising with a disease that is highly reputed for causing toxic marrow depression [5]. Fortunately, however, this complication in most reports, including the current one, remains an insignificant prognostic factor. Judicious use of blood transfusion to correct anaemia and adequate fluid resuscitation probably combined to ensure improved intra-operative oxygen carrying capacity and tissue oxygen delivery in our patients.

Although there is no absolute contraindication to the use of regional anaesthesia, (spinal and epidural), in typhoid perforation, these techniques are best avoided in the presence of hypotension, and septicaemia, especially in our environment where the adequacy of resuscitation cannot be reliably quantified due to paucity of monitoring. General anaesthesia is preferred for these critically ill patients in our center. The technique provides for easier accommodation of, or attention to, haemodynamic changes. The conduct of anaesthesia was individualized to accommodate the varying degrees of systemic disturbance/organ compromise. Thus ketamine was used for

induction in the poor-risk patients to ensure a stable post induction haemodynamic state. Unlike thiopentone, ketamine provides slower induction, avoids sudden after load reduction and preserves organ blood flow in septic patients [14]. Pre-operative gastric decompression with nasogastric tube, rapid sequence induction technique and cricoid pressure were measures employed to minimize the risks of regurgitation and aspiration under anaesthesia.

In most of these patients only enough inspired halothane concentration to prevent awareness is all that is required, while a few poor-risk ones may not even need any volatile anaesthetic supplementation to nitrous oxide anaesthesia. However, complete muscle relaxation must be ensured to provide a good operating condition. Careful titration of inspired halothane concentration and adequate muscle relaxation, employed in a balanced anaesthetic technique, ensured a reasonable level of haemodynamic stability in most of our patients. However, some (25.26%) still developed significant haemodynamic depression at induction and during anaesthesia. The haemodynamic depression recorded at induction in some of the patients, may not be unconnected with the widespread use (63.3%), of thiopentone for induction in these patients, especially those in ASA > III. We feel that the use of ketamine instead of thiopentone for all those in ASA > III, would probably have achieved better peri-operative haemodynamic stability. For instance, the two patients who died intra-operatively were some of the ASA IV patients who were induced with thiopentone. They had severe haemodynamic depression and oliguria, following induction, which initially responded to rapid volume replacement. The patients later suffered further episodes of haemodynamic depressions during surgery, which eventually resulted in cardiac arrest and death. All these are not uncommon in poor risk septic patients that are often encountered in typhoid perforation. The haemodynamic depression is usually due to unmasking of the hypovolaemia earlier compensated for by increased sympathetic activity, which is easily abolished by thiopentone [15]. Thus a wide bore cannula should be favoured in all the patient for intravenous access before anaesthesia to allow rapid volume replacement. A second intravenous access may be necessary after induction, as was the case in some of our patients, in order to maintain haemodynamic stability. Central venous pressure (CVP) monitoring may be considered for a more accurate guide to volume replacement in few selected group with unstable haemodynamic status. However, frequent monitoring of pulse rate and non-invasive blood pressure measurement as employed in our patients would suffice as indicators of volume status in most patients. Urine output was also monitored in our patients as an indicator of the adequacy of tissue perfusion, as it has been shown to be reliable in this regard [5].

Although there was no record of blood loss in our series, intra-operative blood losses are usually moderate. However, blood for transfusion should always be available in the theatre to allow prompt replacement of significant losses. This is particularly so since the initial haemoglobin result may be falsely elevated due to haemoconcentration from dehydration. Blood transfusion in our patient was individualized based on the clinical assessment of the patient reserve to maintain oxygen delivery in the face of increased oxygen demand. About 25% of them required intra-operative blood transfusion, not because of any massive intra-operative blood losses, but because of some mild preoperative anaemia with superimposed moderate surgical blood loss. We always strive to maintain the haemoglobin concentration at or near 10 g/dl (PCV 30%) in these critically ill patients to enhance adequate oxygen carrying capacity. This together with adequate pre-oxygenation and the use of high inspired oxygen concentration (FiO_2 40-50%) intra-operatively was employed to ensure adequate tissue oxygen supply for the expected increase in oxygen consumption on account of sepsis.

The decision to extubate at the end of anaesthesia in these patients should normally be based on the patient's cardiopulmonary status. The patient should be haemodynamically stable, alert, co-operative and fully reversed from any muscle relaxant prior to extubation. Six of our patients who could not meet these criteria in the operating room (Table 6) were transferred to the recovery room with their tube insitu, for further oxygen therapy and haemodynamic resuscitation. One of them was transferred to the intensive care unit (ICU) with the tube. Routine post-operative ICU admission has been advocated by some previous authors, for some categories of these patients to allow further oxygen therapy, cardiorespiratory support and monitoring [16]. This was not a common feature in our series because our ICU was not substantially developed and the necessary gadgets unavailable during the period covered by the study.

Although the mortality rate of 18.95% recorded in this study is still unacceptably high, it is within the range reported by previous authors, except a few who have reported figures as low as 3 to 9 percent [3,17]. It is difficult to establish the contribution of anaesthesia to the mortality in our series. Our results show that most of the patients presented in a compromised physical state (Table 2). Many (61.05%) actually fell into the high anaesthetic risk classification (ASA = 4), with 12.63% of them having no chance of survival with or without surgical intervention [18]. These poor risks patients constituted a statistically significant fraction (P=0.00) of the overall mortality in this study. Surprisingly, 6 patients categorised as ASA V in this series survived, giving a mortality rate of 50% for patients in this risk category (Table II). This reflects the subjective nature of the ASA risk assessment system. Grading may vary depending on the status and experience of the attending anaesthetists. Above all, although it remains one of the few prospective descriptions of patients which correlate with the risks of anaesthesia and surgery, it is not full-proof, and ASA V does not necessarily portend 100% mortality, as seen in this study. Even when patients fall into the high anaesthetic risk physical status, the skills with which the perioperative management is conducted may have a modifying effects on the eventual outcome of surgical intervention. The four patients that died within 24 hours in the ward, although were of high anaesthetic risk classification (ASA = IV), would probably have survived if they were cared for, in the immediate postoperative period, in an Intensive Care Unit well equipped to provide cardiorespiratory support and invasive cardiovascular monitoring such as CVP and intra-arterial pressure monitoring. Like in most other centers in developing countries several problems continue to militate against optimum perioperative care of these patients in our hospital. For instance, serum biochemistry results were not available at all or are incomplete in a sizeable proportion of our patients (77.89%) due to logistic problems such as power outage, lack of reagents or equipment breakdown, which prevented the samples from being processed. This hampered adequate pre-operative assessment and intervention in these patients. Improved facilities in our hospitals and health education to ensure early presentation of the patients in better physical status would no doubt improve surgical outcome.

The characteristics of patients in our series is consistent with those of other reports from Nigeria [6,19,20] and other parts of the world [16]. Also in conformity with previous reports [19,21] only 5 patients (5.26%) were below the age of 5 years. The low prevalence of typhoid fever in the very young, and probably the very old, has previously been attributed to the protection of these groups of patients from contact with the vehicle of transmission of typhoid organism [19]. The very young are actively supervised and restricted in movement by their parents while, the very old are restricted by reduced physical activity. The slight male preponderance in our series is a well-known feature, attributed to increased level of physical activity in males compare to females.

This study suffers from the usual limitations associated with retrospective studies, such as, inadequate records, incomplete information and lack of control. However, we hope our findings would form a useful basis for a future, prospective controlled study.

Conclusion

Perforation of the ileum remains a common complication of typhoid fever with high mortality. The role of the anaesthetist in the multi-disciplinary approach to the total care of the patients can not be overemphasized. Prompt surgical intervention under a carefully conducted anaesthesia, preceded by adequate resuscitation, offer a good chance of survival.

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