Comparative Clinical Effects of Early Pharyngostomy Alimentation and Intravenous Fluid Infusion following Oesophageal Transection and Anastomosis in Nigerian Breeds of Dogs

Omamegbe, J.O.¹; Njoku U.N.²* and Ibup, S.E.²

¹Department of Veterinary Surgery and Radiology, Faculty of Veterinary Medicine, University of Abuja, ²Department of Veterinary Surgery and Radiology, Faculty of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Corresponding author: Email; njoku.uchenjoku@gmail.com, Telephone; +2348063397918

SUMMARY

Twelve adult Nigerian breeds of dogs were used to compare the clinical responses of dogs alimented through pharyngostomy tubes (PGTs) with those maintained on intravenous infusion (50:50 mixture of Ringers lactate and 5% dextrose saline) during the first 14 days following oesophageal transection and anastomosis (OTA). The dogs were assigned to two groups (n=6), the pharyngostomy tube (PGT) group and the intravenous fluid infusion (IVF) group (n=6). Dogs in both groups underwent routine OTA. The PGT group was fed blanched processed dog food at 70g/kg body weight for 14 days through PGTs, while the IVF group was maintained on intravenous fluids at a dose of 70 mL/kg body weight daily also for 14 days post operatively. The postoperative complications observed in both groups showed that the mortality rate in the IVF group (83.3%) was significantly (P < 0.05) higher than in the PGT group (16.7%). Vomiting and leakages at the site of oesophageal anastomosis did not differ significantly between the groups. Cervical swelling was observed in two dogs (33.3%) in the IVF group, while tenesmus and displacement of the tubes were recorded in 66.6% and 100% respectively of the dogs in the PGT group. It is concluded that feeding dogs which had undergone OTA through PGTs during the immediate postoperative period reduces their morbidity and mortality; and shortens the recovery period when compared with similar dogs maintained solely on intravenous fluids.

Keywords: Oesophageal, Transection, Anastomosis, Pharyngostomy, Complications, Morbidity, Mortality.

INTRODUCTION

Oesophagotomy is an acceptable treatment option for the removal of oesophageal foreign bodies and mild oesophageal stenosis (O'Connor, 2005). Although it has the potential of becoming life threatening (Houlton et al., 1985; Kyles,
2003) more complicated oesophageal disorders such as congenital obstructions, acquired discrete strictures, severe localized injuries, diverticula, perforations and neoplasias may require management with partial or total oesophagectomy (OE) and varying degrees of or no gastric mobilization to the cervico-thoracic region (Rosin, 1975; Slatter, 1993; Orton, 1995; Shield et al., 2005; Sutton et al., 2016).

Although surgery can be performed successfully on any portion of the oesophagus (Slatter, 1993), oesophageal surgery is historically associated with higher rates of post-surgical complications than surgery on the gastrointestinal tract (Bonayard et al., 1992). This high rate of complications is accounted for by the absence of a serosal layer on the oesophagus which delays the formation of a quick seal at the site of the oesophageal surgery (Orton, 1995), the segmental blood supply to the oesophagus, the absence of an omentum on the oesophagus, and the constant motion of the oesophagus during deglutition which causes considerable tension at the suture line of an oesophageal anastomosis (OA) (Pavletic, 1981). Despite these factors, oesophageal surgeries can be successful if the oesophageal tissues are handled atraumatically, tissue contamination is kept at a minimum, and the appropriate suture material and patterns are employed in the anastomosis of the transected oesophagus (Orton, 1995).

Mortality rates associated with oesophageal surgeries range from 1.8% to 13% (Bruno et al., 2003; Hsu et al., 2004; Simon et al., 2005; Vigar et al., 2008; Sutton et al., 2016). Other major complications associated with oesophageal surgeries are dehiscence, stenosis and leakage of luminal contents at the site of the OA (Parker and Caywood, 1987; Flanders, 1989). Leakages at the site of OA have been attributed to peri-operative malnutrition, diabetes mellitus, age, hypotension, hypoxaemia and the use of cytotoxic agents (Turkyilmaz, et al; 2009). Most complications of oesophageal surgeries may be eliminated if the procedure is carried out with high degree of fineness (Whooley, et al; 2001).

Human and animal patients intended for oesophageal and most gastrointestinal tract surgeries are usually denied enteral feeding for varying postoperative periods. They are rather sustained on water and electrolytes through parenteral administration of crystalloids. This has been associated with malnutrition, severe weight loss, negative catabolism associated with tissue damage (Page et al., 2002), gastrointestinal mucosal atrophy, lymphopaenia, catheter sepsis and bacterial translocation (Kawasaki, et al., 2009) in such patients. On the other hand, intravenous fluids as the sole source of nutrition for surgical or traumatic patients have been shown to be of very negligible value (Heslin et al., 1997; Page et al., 2002; Kawasaki et al., 2009). In humans for instance, enteric feeding through catheter feeding jejunostomy (Dekany et al., 1977) and naso-jejunostomy tubes (Page et al., 2002) are credited with better postoperative outcomes than the intravenous administration of crystalloids.

Post-operative nutrition of OA patients via gastric and ilial tubes has been reported in humans (Dekany et al., 1977; Page, et al., 2002). The authors are not aware of any report comparing the survival of Nigerian local breeds of dogs fed through a pharyngostomy tobe and maintained by intravenous fluid only, following oesophagotomy..

This study was conducted to compare the clinical responses in dogs alimented through PGTs with
those maintained on intravenous administration of crystalloid fluids following OTA.

MATERIALS AND METHODS
This study was conducted in accordance with the ethical standards in the 1964 Declaration of Helsinki, as operational in Nigeria. The randomized controlled trial design was used for this study.

Twelve clinically healthy Nigerian local dogs (6 males and 6 non-pregnant, non-lactating bitches), aged between 12 and 18 months and weighing 8.0±2.3kg were used for this study. The age of the dogs was estimated by dental examination (Aiello, 1998). They were purchased from a local market in Umuahia, Abia State, Nigeria. They were housed individually in the kennels, and fed once daily on household food. Water was provided ad libitum. The dogs were allowed a period of four weeks to acclimatize to the local conditions. They were dewormed with ivermectin (Ivermectin 2%, Kexing, China) at a dose of 0.4 mg/kg and treated against ticks and tick-borne haemoparasites prior to the experiment. None of the dogs was adjudged to be suffering from any ailment prior the commencement of the experiment.

The dogs were randomly assigned to two groups (n = 6) each, the PGT group and the IVF group. In both groups, food and water were withheld for 24hrs and 12 hours, respectively, prior to surgery. The dogs were premedicated with atropine sulphate (Pauco Pharmaceutical Industry Nigeria Ltd, Nigeria) and xylazine (Kepro, Holland) at doses of 0.04mg/kg and 2mg/kg body weight intramuscularly (i.m.) respectively (Brearley and Heath, 2005).

The ventral aspect of the neck from the larynx to the thoracic inlet was clipped and the skin scrubbed using a 0.003% solution of chlorhexidine (Nanz Med Pharma Private Limited, Delhi). The dogs were anaesthetized with ketamine hydrochloride (Rotexmedica, Germany) at the dose of 15mg/kg body weight, i.m. Anaesthesia was maintained with ketamine at of 7mg/kg i.m as required (Hall, et al., 2001).

Each dog was intubated with endotracheal tube (ID 7.0, Medifield Equipment and Scientific Ltd, England). An oesophageal tube was inserted per os to aid in the identification of the oesophagus prior to its transection. The dog was then positioned and secured in dorsal recumbency. Approximately, a 10cm long ventral midline skin incision was made extending caudally from a point 2 -3 centimeters caudal to the larynx. The sternocephalicus and sternohyoideus muscles were separated in the midline and an OTA was performed using standard procedures as described by Venugopal (2000). At the completion of anastomosis the suture line was checked for leaks by withdrawing the oesophageal tube to a point cranial to the oesophageal suture line and passing 20mls of water through the tube. The water was milked caudally through the oesophageal suture line. Effusion of water through the line of anastomosis was regarded as anastomotic leakage. Such leakages were repaired by the placement of 1-3 additional interrupted sutures at the leaking sites. Dogs in the IVF group were maintained solely on a 50/50 mixture of 5% dextrose saline and Ringer’s lactate solution administered intravenously at a dose of 70mL/kg bwt twice.
daily for the first 14 days postoperatively via 20 G intravenous cannulas (Lakhani Medicare Pvt. Ltd, India) inserted into their cephalic veins. In the dogs in the PGT group, PGTs were inserted into the oesophagus immediately following OA before the access incisions on the muscle layers and skin of the cervical region were closed routinely as described by Slatter (1993). The PGT group was fed blended processed dog food (Binggo, UAC, Nigeria) at the rate of 70g/kg body weight through the PGTs once daily for 14 days postoperatively.

Procaine Penicillin (Laborate Pharmaceutical, India) and streptomycin (Entomycin® Zhejiang Jinling Tianfeng Pharma, China) were administered to all the dogs for five days post operatively at the doses of 10,000 I.U/kg and 20 mg /kg i.m. respectively. Post-operative pain was managed by the intra muscular administration of Piroxicam (Greenfield Pharmaceutical, China) at the dose of 0.3mg/kg for three days.

The dogs were observed for fourteen postoperative days and the occurrence of vomiting, leakage from the site of the oesophageal anastomosis (observed as discharges along the site of skin closure), cervical swelling (anywhere on the ventral aspect of the neck), swelling at the point of entry of the PGT, dislodgement of the PGT, pyloric obstruction with swallowed PGTs, discharge from the point of PGT placement, tenesmus and mortality were recorded.

The association between the placement of PGTs and the occurrence of mortality was determined using Fisher’s Exact Test, using Statistical Package for Social Sciences (SPSS), and values of $P < 0.05$ were considered significant for association.

RESULTS

The incidence of vomiting, leakages at the site of OA and deaths as observed in PGT and IVF groups were presented in Figure 1. These complications occurred between days 1 and 14 postoperatively. There was an association ($p < 0.05$) between the placement of PGT and survival rate of patients, with the mortality rate in the IVF group being significantly higher than in the PGT group. However, there was no association ($p \geq 0.05$) between the occurrence of vomiting and anastomosis leakages and the placement of PGTs. Cervical swelling was observed in the IVF group, while swelling at the pharyngostomy site, dislodgement of PGT, tenesmus and pyloric obstruction were observed in the PGT group only. The postoperative days in which these complications occurred, the number of dogs involved, the interventions instituted and their outcomes are presented in Table 1.

DISCUSSION

Most dogs requiring management with oesophagectomy are usually presented in various degrees of compromised clinical states and pose considerable management risks because of the attendant pytalism, regurgitation and continued fluid deficits particularly in paediatrics and geriatrics. In some of such patients, a partial or rarely total oesophagectomy is required with considerable mobilization of the remaining segments of the oesophagus. In this study no segment of the oesophagus was resected.
TABLE 1: Summary of complications and final outcomes in dogs following OTA and maintenance via PGTs and IVF

| Complications                                      | Postoperative day of occurrence | Numbers involved PGT group | Numbers involved IVF group | Intervention                                      | Outcome                                      |
|----------------------------------------------------|---------------------------------|---------------------------|---------------------------|--------------------------------------------------|----------------------------------------------|
| Cervical swelling                                  | 1                               | 0                         | 2                         | None                                             | Death within 24hrs                           |
| Swelling at site of PGT placement & dislodgement of PGTs | 4-6                             | 6                         | NA                        | Replaced within 12 hrs of dislodgement            | Retained thereafter till end of experiment in all cases |
| Tenesmus                                           | 3                               | 4                         | Nil                       | None                                             | Resolved without any specific management     |
| Pyloric obstruction                                | 2                               | 2                         | NA                        | Gastrotomy                                       | Obstruction was relieved.                    |
| Mucoid discharge from site of PGT placements       | 1-6                             | 2                         | N/A                       | Cleaning and antibiotic dressing                 | Resolved successfully                        |

Figure 1: Rate of occurrence of post-operative complications observed in the IVF and PGT groups. *Different superscripts indicate association (p<0.05) between complications and placement of PGTs*
The most commonly reported complications of OE in humans are respiratory failure and dehiscence of the anastomosis, both of which are reported to be fatal (Michelet, et al., 2005). Complications such as leakage at the site of anastomosis, regurgitation and dysphagia have been reported in dogs following oesophageal surgeries (Mahdi, 2011). The rate at which respiratory failure and anastomotic dehiscence occur is claimed to be directly related to the finesse in the execution of the oesophageal surgery (Whooley, et. al., 2001). The significantly higher survival rate observed in the PGT than the IVF group agrees with the report by Whooley (2001) and corroborates the notion that enteric feeding is superior to IVF administration for the maintenance of patients that have undergone oesophagectomy in humans. This is thought to be due to the early alimentation in the PGT group which apparently maintained intestinal integrity, induced anabolism as against catabolism, counteracted bacterial trans- and re-locations and subsequently reduced the stress response in the PGT group (Page et. al., 2002; Lassen, et al., 2008). These, put together, clearly improved the survival rate of the PGT group over the IVF group.

The occurrence of leakages of oesophageal contents at the site of OA in both groups suggests that creating a by-pass for feeding, or preventing oesophageal motion during deglutition may not completely prevent leakages from the OA site. Such leakages have been reported to be a major cause of post-operative morbidity and mortality in humans following oesophagectomy.

The dislodgement of the PGTs recorded in the PGT dogs has been reported by earlier workers (Slatter, 1993; Summer et al., 2000) and seems to be preventable by adequate anchorage of the PGTs at their stomas. Their prompt replacement ensured that there was little disruption in alimentation. The ultimate effects of the dislodgement of the PGTs or vomiting, particularly in respect to the times they occurred during the immediate post-operative period, on the final post-operative outcome of such cases is not clear. However, they certainly imposed a higher responsibility for post-operative case management than would otherwise have been necessary. The occurrence of vomiting within the first few post-operative days in dogs subjected to OA in this study agrees with the observations of Strombeck, (1990), Collard et al., (1998), Cheryl and Theresea, (2007).

CONCLUSION

In conclusion, placement of PGTs after oesphagectomy and OA resulted in reduced postoperative morbidity and mortality because of the immediate postoperative feeding of the animals. The complications attributable to oesophageal surgery were present in both groups, but they were less lethal in the PGT group because of the immediate postoperative feeding of the dogs through the PGTs. It may be necessary to compare this with other methods of enteral alimentation in dogs to enable conclusions to be drawn about the effectiveness of the different techniques in preventing morbidity and lowering mortality rates on dogs subjected to OTA.
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