

## A Technique for Caecostomy in the Chicken

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A caecostomy technique (surgery for inserting tube into caeca) was developed to quantify urine backflow into the caeca. Two days post-surgery, caecostomised chickens were flushed with 20 ml of warm saline solution every other day for 10 days. After surgery birds temporarily lost appetite and activity, but they were restored gradually in a few days. The incision healed within 10 days post-surgery. Excreta were collected daily from caecal tubing and cloaca by surgical attachment of polyethylene collection vessels to the chickens. Post-mortem examinations ascertained that the caeca were intact around the Latex tubing.

**Key words** – chicken, ceacum, caecostomy, urine back-flow into the caecum

The caeca of birds consist of prominent and structurally distinct diverticula [7] which open from the junction of the ileum and colon [5,16]. In birds, ureteral urine drains into a posterior compartment of the cloaca, usually the urodeum, then moves anteriorly into the coprodeum, colon, and to a certain extent into the caeca and even the ileum [2]. This retrograde urine transport towards the caeca in several species of birds has been demonstrated by a number of researchers (Domestic fowl, [2]; Japanese quail, [9]; Rock ptarmigan, [10]; Domestic turkey, [4]; Guinea fowl, [4]; Domestic geese, [6]).

While antiperistalsis from the cloaca to the colon and caeca has been documented for a number of poultry species, it is not clear how much retrograde urine flow into the caeca occurs in the chicken.

Therefore, in the present study the amount of urine back flow into the caeca of roosters was quantified by inserting Latex tubing into the caeca. This paper describes the surgical procedure and post-operative management, and reports quantitative estimates of retrograde flow of urine into the caeca.

### Materials and Methods

#### Animals and Presurgery

Male White Leghorn roosters, 24 months of age and 2.5 kg body weight, were housed in individual wire cages in an environmentally controlled room at approximately 25.0°C.

Food and water were supplied *ad libitum*. A 12-h light, 12-h dark schedule was maintained. Food was withheld for 12 h and water for 2 h prior to surgery. The roosters were restrained in dorsal recumbency for the surgical procedure (caecostomy). General anaesthesia was administered using Halothane gas (Halocarbon Laboratories, River Edge, NJ 07661). Roosters were induced and maintained under gas anesthesia using an anesthetic mask fabricated in our laboratory specifically for chickens. A slow anaesthetic induction was employed using 2.0% anesthetic gas and an oxygen flow rate of 2 L/min. Upon achieving a surgical plane of anaesthesia, the oxygen flow rate remained constant at 2 L/min, and the anesthetic gas was maintained between 1.75 and 2.00%. Systemic preoperative and postoperative antibiotic therapy was used to prevent infection and eliminate the need for daily injections of antibiotics postsurgery. Prior to preparation of the roosters for surgery, 300,000 IU of penicillin G procaine (Vedco Inc., St. Joseph, MO 64504) was administered subcutaneously. Feathers were removed from the surgical site and the skin scrubbed with betadine scrub (The Purdue Frederick Co., Norwalk, CT 06850). The chickens were then covered with a disposable surgical drape and a defect created in the drape to access the surgical site. Principles of aseptic surgery were observed to prevent complications of infection post-surgery, thus, surgical caps, surgical masks and sterile gloves were worn during the procedures by all individuals present.

#### A surgical process

A 5 cm paramedian skin incision was made on the left side of the abdomen, caudal to the costal arch. The incision

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was continued down through the muscle layers and peritoneum, exposing the distal ends of the caeca. The ends of the caeca were isolated and incised. Tygon tubing attached to a 20 ml syringe was inserted into the caeca, and the caeca flushed with 20 ml of saline solution [21] to remove the caecal contents. Approximately 2.5 cm of 10 cm length of Latex tubing (4.6 mm I.D., VWR Scientific West Chester, PA 19380) were inserted into the caeca, and secured in place by transfixing the tubing to the caeca with 2 simple interrupted stay sutures (Fig. 1). The body wall was closed in three layers; peritoneum, muscle and skin. During closure of the incision, the exposed tubing was transfixed to the body wall by 2 simple interrupted stay sutures (Fig. 2). Immediately after completion of the procedure, 450,000 IU of Dual-Cillin (penicillin G and penicillin G benzathine; Phoenix Pharmaceutical, Inc., Loveland, CO 80538) was administered subcutaneously to maintain postoperative antibiotic blood levels. Two days after surgery, the tubing was flushed with 20 ml of warm saline solution every other day for 10 days.

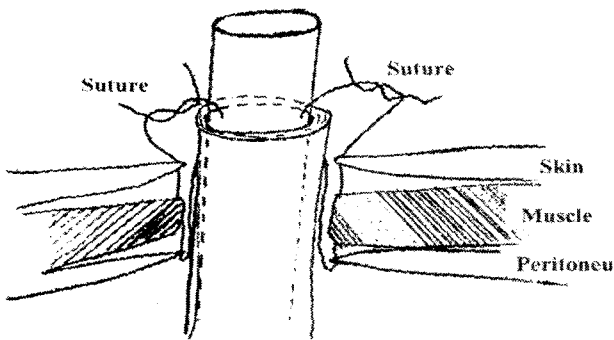


Fig. 1. Schematic diagram showing the procedure for fixation of Latex tubing.

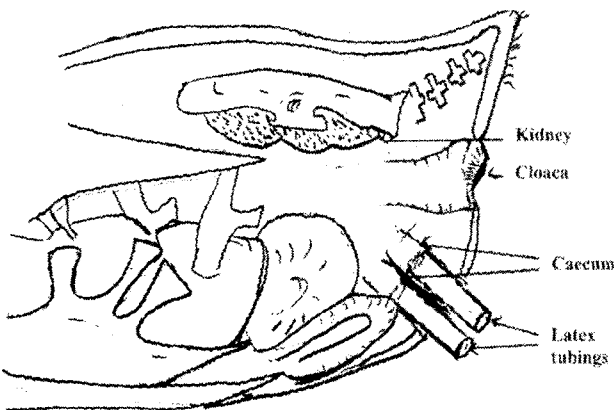


Fig. 2. Side view of the posterior half of the caecostomised chicken.

**Sample collection and Analysis**

Excreta were collected daily from the cloaca and caecal tubing by surgical attachment of plastic bags [1] and polyethylene collection [24] vessels to the roosters (Fig. 3). The plastic bags and polyethylene collection vessels were presprayed with 2 ml of 5.0% HCl to prevent fermentation of the excreta and a change in nitrogen composition. The collected excreta were immediately sprayed with 5.0% HCl and stored in a -80°C freezer. For analysis, the collected excreta was dried at 55°C for 48 h in a forced-air electric oven. The uric acid in excreta was determined by an enzymatic spectrophotometric method [19]. Post-mortem examinations ascertained that Latex tubes are appropriately inserted into each caeca and the caeca were intact around the Latex tubing (Fig. 4). The surgery procedure,



Fig. 3. Picture of the bag and bottle attached to rooster for collecting cloacal and caecal contents.



Fig. 4. Post-mortem examinations of caecal wall around latex tubings from caecostomised chicken.

feeding and collection protocols were approved by the Purdue University Animal Care and Use Committee.

## RESULTS

In 6 of 12 roosters, the caecal tubing functioned well for 4 weeks after surgery with few complications. The new method described in this study required minimal maintenance post-surgery to keep birds healthy and in suitable condition. In 2 of 12 caecostomised roosters were euthanised because the skin surrounding the caecal tubing gradually encroached on the caecostomy site after surgery. Four of 12 caecostomised roosters did not convalesce satisfactorily post-surgery and were thus euthanised. Postmortem examination of these 4 roosters revealed haemorrhage and damage to the mesentery and/ or blood vessels around the caecostomy site. These 4 of 12 caecostomised roosters that did not convalesce satisfactorily experienced large reductions in body weight and had reduced feed and water intake post-surgery. Affected roosters assumed a vulture-like posture. The caecostomised birds should be caged individually and allowed *ad libitum* access to food and water after awakening from anaesthesia. After surgery birds may temporarily lose appetite and activity, but they are restored gradually in a few days. The incision usually heals within 10 d post-surgery.

## DISCUSSION

The surgical technique used in the study allowed us to accomplish our study objective. The chickens produced excreta with a soft, sticky consistency immediately after surgery that gradually normalized 5-7 days post-surgery. In a study such as this, the amount eaten and excreted should be noted each day after surgery to detect possible problems with the caecostomized birds. In this study, caecostomized roosters were in suitable condition after surgery and their feed intakes were similar.

Average dry matter intake was 25 to 40 grams/kg BW/day for conventional and caecostomised roosters used in the experiment. Birds regained most of their body condition within 5 days post-surgery. We assume that the roosters would have regained their lost weight more rapidly if they had not been handled frequently post-surgery. Average weight gains were usually between 10 and 30 grams/day of body weight in healthy chickens that

were accustomed to handling. Previously, it was reported that birds had a greatly increased water turnover after caecal ligation, caecectomy and colostomy [21-23]. Following surgical preparation of the caecostomised roosters, water consumption and excretion were increased, but not as much as observed with colostomy.

In birds, urine contains uric acid as a major end product of nitrogen metabolism instead of urea in mammals [18]. Urinary excretion of uric acid is nearly 100% in the chicken [11,12]. Retrograde movement of urine from the urodeum into the colon and caeca of birds via colonic antiperistalsis [15] is well known [2,8,9,14,20]. This would deliver urinary constituents to the caeca. These results are the first report of quantitative estimates of urine back-flow into the caeca in the chicken. The results of the study raised two pertinent questions. How are the bacteria of the caeca affected by caecostomy, and how do changes in caecal microflora impact uric acid content of excreta. These are important issues since it is possible that the degree of degradation of urinary uric acid in the caeca [3,17] and of the ileo-caecal-colic junction [13] may affect recovery of nitrogen from caecostomised roosters. Another concern regarding the procedure is the effect of caecostomy on lower gut function and urine movement into the caeca.

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## 초록 : 닭에 있어서의 caecostomy (맹장으로 튜브를 삽입하는) 기술

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닭 맹장으로의 尿의 역류량을 측정하기 위해서 Caecostomy (맹장으로 튜브를 삽입하는 수술)기술이 개발되었다. 시술 이틀 뒤부터 맹장에 튜브가 장착된 닭은 20ml의 따뜻한 생리적 식염수를 이용하여 격일간격으로 10일 동안 맹장에 장착된 튜브를 환류시켰다. 시술후 닭은 일시적으로 식욕과 활기가 감퇴되었지만, 몇일내에 정상으로 회복되었다. 수술로 인해 생긴 상처는 시술 10일내에 아물었다. 맹장에 장착된 튜브와 총배설강에 외과적으로 시술된 플라스틱 채집병을 이용하여서 배설물이 매일 모아졌다. 사후검사에서 맹장에 삽입되었던 고무튜브주위를 둘러싸고 있는 완벽한 맹장이 확인되었다.