Unclassified Escherichia coli Serogroup OX1 Isolated from Fatal Diarrhea of Rabbits

Paul J. Glantz*

SUMMARY

An unclassified serogroup of Escherichia coli, OX1, was identified in 151 of 196 isolates from 20 rabbits affected with fatal diarrhea and four with no visible illness. No other known pathogenic bacteria or protozoa were isolated from these rabbits. Six strains of OX1 produced a positive reaction comparable to a known positive-reacting E. coli O26:K60 strain when injected into ligated intestinal loops of young rabbits.

RÉSUMÉ

Un groupe sérique non-classifié d'Escherichia coli, le groupe OX1, fut identifié dans 151 sur 196 prélèvements effectués chez des lapins atteints d'une diarrhée mortelle et chez quatre lapins apparemment sains. On ne put en isoler aucun autre agent reconnu comme pathogène. Six souches de OX1 produisirent une réaction positive comparable à celle d'une souche d'E coli O26:K60, lorsqu'on les injecta dans des anses intestinales ligaturées de jeunes lapins.

INTRODUCTION

Gastrointestinal disorders in rabbits generally appear due to a variety of conditions that include bacteria, viruses, protozoa, nutrition and husbandry (4, 5, 6, 7). Diarrhea and/or enteritis, common in laboratories and rabbitries, may have a high incidence and mortality. Prevention and treatment methods are not always successful.

It is known that certain serotypes of *Escherichia coli* produce enterotoxins and are enteropathogenic for neonatal animals (8). In this report, the role of an unclassified *E. coli* serogroup OX1 isolated from rabbits that had diarrhea and died suddenly was examined.

MATERIALS AND METHODS

Nine cases, involving 20 young rabbits that had diarrhea and died suddenly were submitted for necropsy to the Diagnostic Pathology Laboratory, Western College of Veterinary Medicine. Although inflammation with hemorrhage was found in the cecum of some rabbits, these changes were not consistent. One group of five rabbits had received penicillin and/or different types of feed before necropsy but only one had evidence of pathological changes in the intestinal tract. Specimens (large and small intestine, cecum, stomach and pus from bladder), were examined for parasites and bacteria. Bacterial isolates from MacConkey and Blood Agar media were identified by biochemical reactions. From two to 35 colonies of *E. coli* isolated from each rabbit were then tested with 149 standard and 45 unclassified *E. coli* O serums (2). The unclassified *E. coli* serogroups OX1 to OX13 were designated by Ewing (2) and the OX14 to OX45 by Glantz (3).

Eight cultures of *E. coli* serogroup OX1 isolated in this study, and one each of *E. coli* stock 0.22, 0132, OX36 and O26:K60 were tested for enteropathogenicity by the ligated intestinal loop method in rabbits (1, 8, 9). Four adult (4 kg) and two young (1.8 kg) rabbits were used. The volume and incubation time of each culture injected was the same in each rabbit, but was varied for the different rabbits. The dosage was 0.25 ml to 1 ml of seven and 24 hour broth cultures in the adult rabbits and 0.5 ml of 24 hour broth culture in the young rabbits. Rabbits were killed 24 hours after injection, results were recorded (8, 9), and all segments were cultured for bacteriological and serological identification of *E. coli* strains.

*Department of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

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RESULTS

E. coli serogroup OX1 was identified in 151 of the 196 cultures isolated from 24 rabbits and predominated in nine of the ten cases (Table I). In one group of seven rabbits (#1641) only *E. coli* OX1 was isolated from five; a sixth had *E. coli* O15 and O83 and the cultures from the seventh were O negative. Two rabbits (1708) did not yield *E. coli* OX1, the isolates being *E. coli* Olab and O85. Only serogroup OX1 was recovered from rabbits in case numbers 1870, 1906, 1939 and 1864. In the experimental group (E-1), 18 isolates from three rabbits were OX1 while ten isolates from the other rabbit was *E. coli* O132. These four rabbits were not ill but a fifth (E-2) had diarrhea and the *E. coli* isolates were OX1. The latter was isolated with *E. coli* O2a in #1746. In case number 1965, fifteen isolates from three rabbits were OX1 and three were O22.

Tests in the ligated intestinal loops of the four adult rabbits were negative, probably due to the rabbits' age. Yuill and Hanson (10) reported that the age of the host appeared to play a role in the susceptibility to and development of terminal effects of *E. coli* enteritis. In the two young rabbits, six of the OX1 cultures produced dilation and fluid volume equivalent in degree to the known positive reactor O26:K60. An OX36 culture that had been positive in ligated loops in pigs also produced a positive reaction in these two rabbits. The O22 and O132 cultures were positive in one rabbit and negative in the second.

The *E. coli* serogroup injected into a ligated intestinal loop was re-isolated from that loop. Control loops were negative or had an *E. coli* serogroup different from those being used for injection. Transfer of *E. coli* via seepage or the lymphatic ducts from one loop to another was not evident.

DISCUSSION

The large number of *E. coli* cultures examined in this report that belonged to the unclassified serogroup OX1 may be an indication of their association with the diarrhea and enteritis present in the rabbits. This would be most apparent in those rabbits where *E. coli* OX1 predominated throughout the intestinal tract. No other known pathogenic bacteria or protozoa were isolated from the rabbits, but viral studies were not done.

The results obtained when the OX1 cultures were injected into intestinal loops of young rabbits suggests evidence of pathogenicity. Caution must be exercised in evaluating these results since a number of factors (age, husbandry, diet and breed) are involved (9, 10). The young (1.8 kg) rabbits approximated the weight of those used by Taylor *et al* (9) and Arm *et al* (1). In addition to variations in rabbit susceptibility due to age of the animal, loss of ability to elicit a response in the intestinal segments could be due to storage on artificial media (1, 8, 9). Further studies are required to confirm the pathogenicity of the unclassified *E. coli* OX1 serogroup in rabbits.

TABLE I. E. coli Serogroups Isolated from Rabbits

Case No.	Diagnosis	No. of Rabbits	No. of E. coli		Other E. coli O group (No. isolates)
			Isolates	OX1	
1641	Diarrhea	7	86	71	O15(3); O83(3); N(8)
1708	Diarrhea	2	14	0	Olab(8); O85(3); N(3)
1870	Diarrhea	1	9	9	0
1960	Diarrhea	3	9	9	0
E-1[a]	No illness	4	28	18	O132(10)
E-2[a]	Enteritis	1	20	20	0
1746	Diarrhea	1	6	3	O2a(3)
1939	Diarrhea	1	3	3	0
1864	Diarrhea	1	3	3	0
1965	Diarrhea	3	18	15	O22(3)
Total	10	24	196	151	44

[a]Experimental group receiving penicillin, and/or different types of feed.
N = Serologically negative.

The unclassified *E. coli* serogroup OX1 was identified due to the extensive collection of typing serums utilized in this laboratory and would have remained undetected if only routine serums were used. Further research is contemplated including other factors associated with enteritis and diarrhea in rabbits.

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Book Review

TEXT-ATLAS OF CAT ANATOMY. *James E. Crouch. Published by Lea & Febiger and the Macmillan Co. of Canada Limited, Toronto, Canada, 1969. 340 pages, cloth bound. Price $27.50.*

This Atlas of Cat Anatomy offers one of the most comprehensive treatments of the subject that we have yet seen. As the title suggests, Dr. Crouch has compiled a readable volume with an excellent series of "in situ" illustrations. He has succeeded in keeping the reading material to a minimum while retaining those features considered most important to the student of mammalian anatomy.

Especially significant structures are emphasized through boldface type both in the text and labelled drawings. In most instances, the text and associated illustrations appear on facing pages for the added convenience when referring to the dissection drawings while following the text. The approximately 115 drawings are of excellent quality — many in color. Dr. Crouch follows the classic systemic divisions of anatomy: skeletal, integumentary, muscular, digestive and respiratory, circulatory, urogenital, lymphatic, and nervous systems.

Periodically, he compares features of cat anatomy with that of the human and other species. This is in keeping with his conception of the cat as a prototype of mammalian anatomy.

The nomenclature largely follows *Nomina Anatomica*, second edition, 1961. Where a substantial variation exists with the classic terminology, the older form is given in parenthesis.

Short sections at the ends of the book deal with the human ear, tongue, retina of the eye, and endocrine glands.

The Atlas concludes with an alphabetically arranged table of muscles, a tabulated outline of cranial nerves, and a substantial glossary.

Although the price of this volume might be somewhat prohibitive for general student use, this quality Atlas of Cat Anatomy will furnish an excellent source of reference for students of human and veterinary medicine, nursing, medical technology, etc., or as an extremely worthwhile addition to the library of anyone deeply involved in these subjects. — *T. M. Maxwell.*