COMMENTARY

A Meta analysis of history and functions of vermiform appendix

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Introduction:
The vermiform appendix is a narrow blind tube arising from the postero-medial wall of caecum1. Embryologically, the appendix is a continuation of the cecum and is first delineated during the fifth month of gestation[1,2]. The appendix does not elongate as rapidly as the rest of the colon, thus forming a worm like structure.1,3 The appendix averages 10 cm in length but can range from 2-20 cm. The wall of the appendix consists of two layers of muscle, an inner circular and outer longitudinal. The longitudinal layer is a continuation of the taeniae coli. The appendix is lined by colonic epithelium.[1,2] Few submucosal lymphoid follicles are noted at birth. These follicles enlarge, peak from 12-20 years, and then decrease. This correlates with the incidence of appendicitis[3].

History of appendix:
The word vermiform derived from the Latin word "Vermiforma" means worm shape, hence called 'vermiform'. Anatomically, it is one of the mobile viscera of abdomen [1,3] about 1cm longer in male than in female [4].

The appendix was probably first noted as early as the Egyptian civilization (3000BC). Appendix was not found by Aristotle and Galen because they both dissected lower animals, which do not have appendices.5 Celsus, however, probably discovered the appendix because he was allowed by Caesar to dissect criminals. Leonardo da Vinci first depicted the appendix in anatomic drawings in 1492.2,[7,8] In 1521, Jacopo Beregari da Capri, a professor of anatomy in Bologna, identified the appendix as an anatomic structure while Phillipe Verheyen give the term appendix vermiform in 1710.[8]

The Year 1986 was the 250th anniversary9 of the first successful removal of the appendix (appendectomy) and the 100th anniversary2 of the word 'appendicitis' is being used in the surgical literature.

As the appendix, appendicis is a Latin word' means an appendage -an addition at the end (for example of a book), being an addition almost as an afterthought and not regarded as of great value to the overall theme of the topic at hand. Thus whereas the choice of the adjective 'vermiform', meaning worm-like, is accurately descriptive of the organ, the choice of the noun 'appendix' from the beginning of the organ's nomenclature, gave it little chance of ever being considered important.[9,10]

In a review article on 'A History of Appendicitis', in a presidential address to the 94th meeting of the Southern Surgical Association, G. Rainey Williams, of the University of Oklahoma Department of Surgery, pointed out that the reason the appendix is not mentioned in very early anatomical studies is probably because the studies were done on animals not possessing an appendix[11]. Perusing the above and other excellent review articles on the history of the appendix (Kelly and Hurdon,[12] Shepherd,[13] Seal[14] and Maingot15) allows one to outline the highlights of such a history:

In1492 Leonardo da Vinci clearly depicted the organ in his anatomical drawings. Berengario DaCarpi first described the organ in1521 while Vido Vidius first named the worm-like organ as the vermiform appendix in 1530. In 1543 Andreas Vesalius had it well illustrated in 'De Humani Corporis Fabrica.. Lorenz Heister gave the

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first good description of a case of acute appendicitis—a post mortem on an executed criminal in 1711.

Claudius Amyand performed the first successful appendicectomy. The appendix was perforated by a pin, and surrounding omentum was removed through a scrotal wound while dealing with a faecal fistula in a chronic hernia in an 11-year-old boy in 1735. John Hunter described a gangrenous appendix at post mortem in1767. John Parkinson first described a faecolith in a perforated appendix at post mortem in 1812.

Francois Melier suggested the possibility of appendicectomy as an operation. Dupuytren opposed this view in 1827. Bright and Addison published a medical textbook clearly outlining the symptomatology of acute appendicitis. Hodgkin agreed in 1839. Onwards anaesthesia took off, perityphlitis abscesses drained by Hancock in 1850, Willard Parker in 1867 and others in 1870. Joseph Lister gave his first paper on 'Antisepsis' in 1867.

Lawson Tait operated with the intent of performing appendicectomy having made a preoperative diagnosis of disease of the organ in 1880. Abraham Groves of Ontario did likewise in 1883.

Mikulicz in Krakow recommended and performed surgery for appendicitis. Kronlein in Germany did likewise in 1884. In1885 Charter Symonds, an Englishman, performed the first interval operation for appendicitis but did not remove the appendix. Hall of New York in May performed appendicectomy but had not commenced the operation with such intent in 1886.

Sir Frederick Treves of London unkinked an appendix in February of that year. Morton, seven years after Tait in England and four years after Groves in Canada, in April of that year performed the first deliberated appendicectomy for appendicitis in the United States. Treves recommended interval appendicectomy in September of that year. Sands in December of that year removed an appendix, thus following what he had

Figure 1: *Earliest picture of vermiform appendix by Leonardo da Vinci 1492*

been preaching for some time in 1887. In 1888 Onwards for a decade brought improvement of technique of Treves, Senn, McBurney, Weir, Worcester, Fowler, Deaver, Marcy and Richardson.

In June 18, 1886, at the first meeting of the Association of American Physicians in Washington DC, Sternberg, Welch and Osler give the first good description of perityphlitis and iliac passion by Reginald Heber Fitz, who was Shattuck Professor of Pathological Anatomy at Harvard University.

R.H. Fitz read a paper entitled 'Perforating Inflammation on the Vermiform Appendix with Special Reference to its Early Diagnosis and Treatment'. He had been a pupil of Virchow, and being a pathologist gave a detailed description of the pathology of the condition. He used the term 'acute appendicitis', which mixes a Latin root 'appendix, appendicis f.' and the Greek suffix '-itis' implying inflammation and recommended early surgery removal as treatment. He is also noted for a very good paper in 1889 on 'Pancreatitis'. June -McArthur was to speak on a muscle- splitting incision but the meeting went over time and he did not present his paper.

McBurney outlined the grid-iron incision and named his 'point' in 1894. Oschner and Sherren suggested a conservative regime to prevent infection spreading making subsequent surgery safer in1902. Murphy reported 2,000 appendicectomies between 1880 and 1903 mostly being what we call interval appendicectomies and named his triad (pain, vomiting and R.I.F. tenderness)

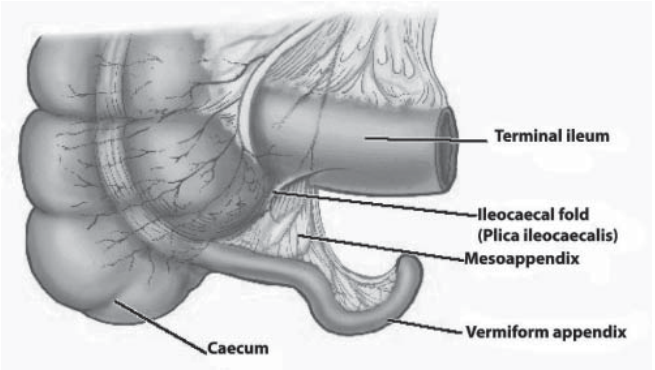

Figure 2: *Vermiform Appendix and its related structures*

in 1904. In 1905 Rockey described a transverse skin incision, which Elliot had done in 1896. Davis, Harrington, Weir and Fowler all wrote on appendicectomy and incisions in1906.

Among famous American surgeons of the time, Ephraim McDowell died of the disease, as did Fowler, whereas Wangensteen survived. Walter Reid died of the disease. Harvey Gushing, the father of modern neurosurgery, survived and Halsted was his surgeon.

Sir Frederick Treves was 'The Elephant Man's surgeon. In 1902 he operated on Edward VII for an acute appendicitis with abscess the very day before the King (as successor to his mother Queen Victoria, who died in 1901) was to have his coronation. The coronation, of course, had to be postponed. Treves performed the first unkinking of the appendix operation (1887) and in England and Europe was known as a proponent for interval appendicectomy (also 1887). He described the bloodless fold as part of the mesentery of the appendix, wrote on the positions or the appendix around the caecal apex according to a clock race, and also wrote on the types or caecum to which the appendix was attached. His own daughter died of acute appendicitis.

Functions of appendix:

Vermiform appendix performs some functions related to gastrointestinal tract, the main function being immunological.[1,5,6] It has also been stated that vermiform appendix acts like tonsil. As the tonsil guard's upper alimentary tract from bacteria, the vermiform appendix also guards the small intestine from bacteria present in the large intestine.[3,4]

Not only it is useless, but it is sometimes the cause of death, of which fact I have lately heard of two instances: this is due to small hard bodies, such as seeds, entering the passage, and causing inflammation. (M. C. Martins, and Haeckel) They have both remarked on the fact of this rudiment sometimes causing death..

Darwin classed this appendage as vestigial organ, because it is greatly reduced compared to the homologous organs in non-human relatives, and because it currently exhibits a great range of variation, which is apparently non-functional. These are criteria which the paper in question does not refute at all. Darwin does say that the appendix is "useless", and the paper will show some evidence that, that is wrong. It's also irrelevant.[10,11]The reason why it is irrelevant is that the presence of some function is not part of the definition of a vestigial or rudimentary organ. Darwin obligingly concedes that evolution will salvage some utility out of organs with little retention of their original function, but which are present as a consequence of contingency. He discusses this at greater length in On the Origin of Species, and here is a significant chunk of the relevant writing[10,11].

The folowing are the functions of vermiform appendix.

1. Embryological
2. Physiological
3. Microbiological (Bacteriological)
4. Biochemical
5. Immunological

1. Embryologica[12,16]

During the fifth foetal week it is the appendix which develops from a bud at the junction of the small and large bowel and undergoes rapid growth into a pouch. In the sixth week there is a transient nubbin surmounting the pouch indicative of being involved in the rapid development of the pouch which is very strategically placed near the apex of the highly significant mid-gut loop. The embryonic appendix has finger-like projections (villi) on its inside surface

2. Physiological [17,18,19]

The goblet cells lining the appendix and adjacent caecum and colon secrete a special type of mucus which can be regarded as an antibacterial paint controlling the organisms which develop in the bowel in the region. The paint contains a high concentration of IgA type immunoglobulins, secretory antibodies produced for mucosal or surface immunity and part of the bowel-blood barrier.

3. Bacteriological [2,17,18,19,20]

Through the cells within and overlying the lymphoid follicles and their production of secretory and humoral antibodies the appendix would be involved in the control of essential bacteria come to reside in the caecum and colon in neonatal life. As well it would be involved in the development of systemic tolerance to certain antigenic agents within the alimentary tract whether they are derived from bacteria, foodstuffs or even the body's own proteolytic enzymes.

4. Biochemical [2]

One in three hundred or so appendectomy specimens contains a carcinoid tumour composed of a highly specialised type of cell rich in vaso-active peptides such as serotonin. The exact function of such agents in the entire bowel is still being elucidated, but the fact that the majority of such tumours occur within the appendix is indicative that the appendix could well be involved in some way with such substances.

5. Immunological [2,3,4,17,18,19,20,21,22,23,24]

This is the area where the appendix would seem to have its predominant functions due to its content of lymphoid follicles, which are highly specialized structures. Although it was thought the appendix itself could be the site for B-lymphocyte induction, the latest opinions favour this programming being more centralized in the bone marrow. The appendix may still have a role in this highly significant function, but not alone, and its lymphoid tissue is known for certain to be involved in antibody production. These antibodies are of two types:

IgA type immunoglobulins for secretory or mucosal surface immunity, and

IgM and IgG immunoglobulins for humoral or bloodstream immunity.

Conclusion:

The appendix, appendicis is a Latin word' means an appendage. The appendix was first noted as early as the Egyptian civilization (3000BC). Appendix was not found by Aristotle and Galen because they both dissect the lower animals; however Celsus find the appendix in human beings. Leonardo da Vinci in 1492 clearly depicted the organ in his anatomical drawings. Berengario DaCarpi first described the organ 1521.while Vido Vidius first named the worm-like organ as the vermiform appendix in1530. Claudius Amyand performed the first successful appendicectomy in 1735.

Murphy reported 2,000 appendicectomies between 1880 and 1903, and named his triad (pain, vomiting and R.I.F. tenderness in 1904. Davis, Harrington, Weir and Fowler all wrote on appendicectomy and incisions in 1906

Darwin does say that the appendix is "useless", and the paper will show some evidence that it is wrong and it is also irrelevant[10,11]. Darwin obligingly concedes that evolution will salvage some utility out of organs with little retention of their original function, but which are present as a consequence of contingency. So appendix is not a useless organ but it has some functions which are Immunological[2,3,4,17,18,19,20,21,22,23,24] Biochemical,[2] Bacteriological, [2,17,18,19,20]. Physiological[17,18,19] and, Embryological. [2,16]

References:

1. Borley NR. Vermiform appendix, In: Standing S, Ellis H, Healy JC, Johnson D, Williams A, Collins P, et al., editors. Gray's anatomy: the anatomical basis of clinical practice. 39th ed. Edinburgh: Elsevier Churchill Livingstone; 2005. p1189- 90.
2. Sadler, T.W.: Langman's Medical embryology. 10th Ed; Williams and Wilkins. Baltimor. (2006), p. 221-2.
3. Sabiston, D. C., Townsend, Courtney M.: Sabiston's textbook of surgery, the biological basis of modern surgical practice. in : Appendix. 16th Ed; Vol 2; W.B. Saunders Company. Philadelphia. (2001), p: 918
4. Seal. A., 1981. Appendicitis: a historical review. Canadian J. of Surg., 24(4): 427.
5. Schwartz, S.J. Shires, G.T., Spencer, F.C., Daly, J.M., Fischer, J.E., Galloway, A,C.: Principles of surgery Schwartz. In: The Appendix. 7th Ed; Vol 3. MC Graw-Hill. Philadelphia.

(1999) p.1383 – 5.
6. Moore KL, Dalley AF. Clinically oriented anatomy. 5th Ed. Philadelphia: Williams and Wilkins; 2006. p. 273-275.
7. Glover JW. The human vermiform appendix: TJ Arch 1988; 3(1): 31 8.
8. Wakeley CPG, The position of the vermiform appendix as ascertained by an analysis of 10,000 cases. J Anat. 1933; 67: 277 83.
9. Williams. G.R., A history or appendicitis. Ann. Surg, 1983. 197:495
10. Darwin, C., The Descent of Man, J. Murray, London; esp. 1871. pp.17-33.
11. Ruse, M., Darwinism Defended, Addison-Wesley. 1982.
12. Kelly. H.A. and Hurdon. E., The Vermiform Appendix and Its Diseases. W.B. Saunders, Philadelphia. 1905.
13. Shepherd. J.A.,. Surgery of the Acute Abdomen. E. & S. Livingston Ltd 1960. p.401
14. Seal. A., Appendicitis: a historical review. Canadian J. of Surg. 1981., 24(4):427
15. Maingol. R., Abdominal Operations. Applelon-Century-Crofts, 6th edition. 1974. Vol.2., p.1370
16. Way, L.W., Current Surgical Diagnosis and Treatment, Lange. seventh edition. 1985.
17. England. M.A.. 1983. A Colour Atlas of Life Before Birth. Wolfe Med.
18. Chadwick. V.S. and Phillips. S., Small Intestine B.I.M.R. Gastroenterology 2. Butterworth. 1982.
19. Alexander-Williams. I. and Binder. H.I., Large Intestine B.I.M.R. Gastroenterology 3. Butterworth. 1983.
20. Doe. W. Immunology of the gastrointestinal tract. Medicine International. 1986..2:1044.
21. Perey. D. Y., Cooper. M.D. and Good. R.A... The mammalian homologue of the avian Bursa of Fabricius. Surgery,1896, 614:614.
22. Sussdorf. D.M. and Draper. L.R... Antibodies in rabbits after irradiation; shielding the appendix. J. of Infect. Dis., 1956, 99:129
23. Archer. O.K.. Sutherland. D.R. and Good. R.A... The appendix in rabbits after neonatal thymectomy. Nature. 2, 1963, 300:337
24. Wangensteen. O.H. and Dennis. C. Experimental proof of the obstructive origin of appendicitis in man. Ann. surg. 1939, 110:629.