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Appendicitis—a study of incidence, death rates and consumption of hospital resources

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Summary

The incidence of appendicitis in a population of 1·07 million is estimated based on discharge rates compiled by the Central Bureau of Statistics for the years 1977 and 1978. A crude incidence rate of 140 per 100,000 inhabitants is found with a male dominance (153 *v.* 126). The lowest incidence rate is found in the age group 0–4, whereas the highest rates are found for patients 15–24 years of age. Seventy-four per cent of all appendicitis cases is found in the age group 5–34 years. The mean length of stay was 6·5 days, but with differences between the counties studied of up to 60%. A yearly death rate of 0·30–0·37% with a male dominance is revealed. Appendicitis cases consume only 1·2% of all hospital discharges but 11·8% of all discharges for gastrointestinal diseases. A comparison with previous studies is performed and it is suggested that most of the reported reduction in incidence rates for appendicitis most probably is caused by a more reliable data base in the recent years.

KEY WORDS: appendicectomy, gastrointestinal diseases.

Appendicitis is one of the most common surgical diseases in a community, leading to hospitalization and operation. However, the incidence and death rates, as well as data concerning the consumption of hospital resources vary considerably even within the same ethnic group (West and Carey, 1978) suggesting that the results published may reflect differences in medical care of these patients rather than true differences in incidence of the disease. Similarly some authors have also published sex differences with female dominance which is difficult to understand if we accept that appendicitis has a common cause in both sexes (Burkitt, 1971).

As suggested by West and Roberts (1974), some of the differences may be due to inaccuracy of the data base. The National Health Care system in Norway (and the other Scandinavian countries) combined with an information system compiled by the Central Bureau of Statistics in Norway (ØMI-system, i.e. Economical and Medical Information System) make it possible to perform detailed estimations for specified diseases. It is the purpose of this paper to give incidence and death rates for appendicitis in Norway based on ØMI data, as well as data concerning consumption of hospital resources for this disease.

Material and methods

Data from the Economical and Medical Information system for the years 1977 (Central Bureau of Statistics, 1979a) and 1978 (Central Bureau of Statistics, 1980) for patients with the principal diagnosis of appendicitis corresponding to the International Classification of Diseases (8th edn., W.H.O., 1967) code no. 540–543 for six counties in Norway (population 1·07 million) were studied. Factors examined were: number of discharges and bed-days, mean length of stay, discharge rates by age groups and sex, and number of admissions terminated by death. The total number of discharges and bed-days (birth and birth-related disorders (ICD code no. 630–678) excluded) for all hospitals in the six counties was also recorded, as well as data for gastrointestinal diseases (ICD code no. 008–009, 530–577 and 785). The death rates were further cross-checked with official causes of death for the two years (Central Bureau of Statistics, 1978b and 1979c).

The incidence rates were estimated based on detailed population surveys for each year (Central Bureau of Statistics, 1978a, 1979b). The estimates were performed separately for the years 1977 and 1978, and the results are given as the mean values for these 2 years.

Results

The total number of discharges for appendicitis for the years 1977 and 1978 was 2988 (1526 men, 1460 women) giving a crude yearly incidence of appendicitis of 140 per 100,000 inhabitants.

Table 1 gives the incidence rates for each sex which

for men is 21·4% higher than for women (153 *v.* 126 discharges per 100,000 inhabitants). The difference in number of bed-days for this disease is somewhat smaller (10·6% higher for men than for women) reflecting a longer mean length of stay for females.

TABLE 1. Number of discharges and bed-days for appendicitis per 100,000 inhabitants, and mean length of stay

	Both sexes	Male	Female
Discharges	140	153	126
Bed-days	910	957	865
Mean length of stay (days)	6·5	6·2	6·8

The length of stay within each of the six counties is shown in Fig. 1. Based on the rates highest/lowest, differences in length of stay of up to 60% are revealed.

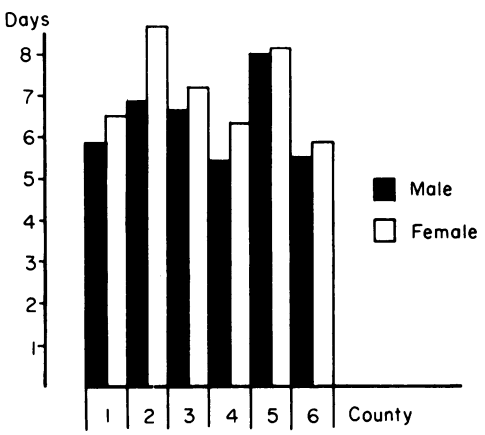

FIG. 1. Length of stay for appendicitis in six counties in Norway.

The proportions of the total number of patients with appendicitis within each age group and sex are given in Fig. 2. Of all appendicitis cases, 74·2% are found within the age group 5–34 years.

The incidence rates by age groups and sex are given in Table 2. The lowest incidence of appendicitis is found in the age group 0–4 years, whereas the highest rates for both sexes are found for patients 15–24 years of age. The incidence rates for patients above 45 years of age show only small age group variations. The estimated sex ratios show that appendicitis is more common in males than in females except in the age groups 0–4 and 5–14.

Eleven patients treated for appendicitis in 1977 and 1978 died during the hospitalization period giving a yearly crude death rate of 0·37%. Death rate for men was 0·55% and for women 0·15%. For the

TABLE 2. Discharge rates per 100,000 inhabitants for appendicitis by age group and sex

Age group	Both sexes	Male	Female	Sex ratio (male/female)
0–4	38	34	41	0·8
5–14	249	249	248	1·0
15–24	266	279	251	1·1
25–34	143	174	109	1·6
35–44	90	115	64	1·8
45–54	67	81	53	1·5
55–64	76	79	74	1·1
65–74	57	58	56	1·0
≥75	62	75	54	1·4

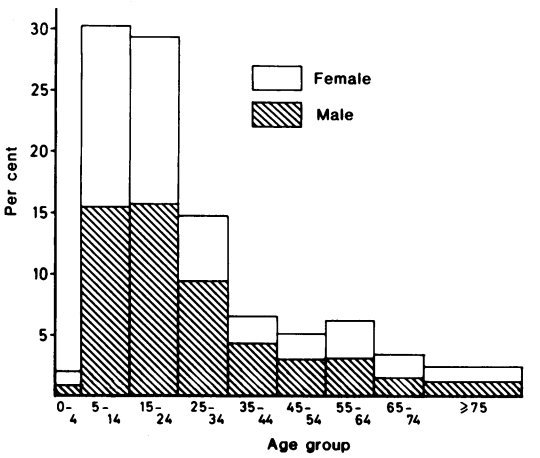

FIG. 2. Proportion of total number of discharges for appendicitis by age group and sex.

population as a whole, an estimated death rate of 5 per million inhabitants per year for appendicitis is found (9 per million for men, 2 per million for women). These figures were crosschecked with the Official Causes of Death which shows that nine deaths during the years 1977 and 1978 were caused by appendicitis, giving a yearly crude death rate of 0·30% (0·46% for men, 0·14% for women), corresponding to a yearly death rate of 6·6 per million inhabitants for men and 1·9 per million inhabitants for women (4·3 per million both sexes).

Patients with appendicitis consumed 11·8% of all hospital discharges for gastrointestinal diseases (men 11·4%, women 12·2%) and 8·2% of all bed-days (men 8·4%, women 8·1%). Compared with the total number of discharges the proportion for appendicitis was 1·2% (men 1·3%, women 1·2%), and appendicitis patients consumed 0·8% of all bed-days (no sex difference). Table 3 gives proportions of discharges for treatment of appendicitis for various age groups.

TABLE 3. Discharges for appendicitis (%) compared with the total number of discharges in the hospitals, and with the number of discharges for gastrointestinal diseases within each age group

	Compared with gastrointestinal diseases			Compared with total number of discharges		
Age group	Both sexes	Male	Female	Both sexes	Male	Female
0–4	4·0	2·1	5·8	0·4	0·3	0·4
5–14	42·4	38·0	46·7	4·8	4·1	5·6
15–24	38·1	41·1	35·0	3·6	4·2	3·0
25–34	18·3	20·4	16·2	2·0	2·8	1·2
35–44	9·1	10·2	8·0	1·0	1·4	0·6
45–54	5·0	5·2	4·9	0·5	0·7	0·4
55–64	4·5	3·6	5·3	0·5	0·5	0·5
65–74	2·7	2·3	3·1	0·3	0·2	0·3
≥75	2·7	2·2	2·1	0·3	0·3	0·2

TABLE 4. Incidence rates for appendicitis. Review of some previously published studies

	Incidence per 100,000 per year					
Country	Male	Both sexes	Female	Data sample	Years	References
U.S.A.	—	400	—	New York state population	1930–1950	Collins *et al.*, 1955
England	—	210	—	Total population	1956–1957	Ministry of Health, 1959
Chile	—	280	—	Total population	1960	Clements *et al.*, 1965
Hawaii	—	127	—	Plantation workers	1961	Larsen, 1962
U.S.A.	200	—	140	New York state population	1962	Pearson *et al.*, 1968
England	230	—	260	Liverpool city population	1962	Pearson *et al.*, 1968
Sweden	310	—	270	Uppsala city population	1964	Pearson *et al.*, 1968
U.S.A.	—	213	—		1963–1964	National Center for Health Statistics, 1966
U.S.A.	150	—	190	Employed, insurance company	1965	Metropolitan Life Statistical Bulletin, 1969
Germany	540	—	604	Health insured persons	1966	Lichtner & Pflanz, 1971
Germany		1040		Population armed forces	1967	Lichtner & Pflanz, 1971
Germany	522		668	Hannover City population	1966–1967	Lichtner & Pflanz, 1971
Wales	—	190	—	Total population	1971	West & Roberts, 1974
England	—	210	—	South East London Region	1972	Department of Health and Social Security, 1974
England	—	140	—	Sheffield city population	1972	Department of Health and Social Security, 1974
Wales		(see figures in paper)		Total population	1976	West & Carey, 1978
Sweden	—	160	—	Lund city population	1975–1979	Arnbjørnsson *et al.*, 1982
Norway	153	140	126	Population 6 counties	1977–1978	present study

Discussion

The incidence rate for appendicitis reported in this study is markedly lower than those reported by most authors. For comparison, Table 4 gives some data from previous studies. The apparent reduction in incidence rate may be explained by at least three factors. First, there is a true falling incidence of appendicitis. Second, significant changes have occurred in the data base used for estimations, and third, demographic changes may explain the differences in overall (crude) incidence rates.

A recent published study (Raguveer-Saran and Keddie, 1980) have demonstrated a falling incidence of appendicitis in England and Wales. If this is true, the figures given in Table 4 and the present results are more easy to interpret due to the time interval between the present and previous studies. However, as pointed out by Jessop (1981) the fall in incidence is in fact a fall in the incidence of what the Hospital Inpatient Enquiry (Department of Health and Social Security, 1973; Department of Health and Social Security, 1974) calls 'unqualified' appendicitis, and that the number of cases with acute appendicitis showed no marked changes during the time period. Thus, without further longitudinal studies, it is difficult to accept a statement of a true falling

incidence of appendicitis, although some older (Castleton, Puestow and Sauer, 1959; Verda and Platt, 1958; Larsen, 1962) and a more recent (Arnbjørnsson, Asp and Weston, 1982) support the theory of a decreasing frequency of the disease.

These observations show that the quality of the data base used for estimations is of great importance. When authors include in their incidence rates patients obtaining planned admission to hospital ('non-acute appendicitis', Castleton *et al.*, 1959; West and Roberts, 1974), figures reveal that appendicitis apparently was non-existent during weekends (Lichtner and Pflanz, 1971), or show that appendicectomy in a significant number of cases was not performed on the grounds of acute appendicitis (Georgakopolous, 1974; Lichtner and Pflanz, 1971; Meyer, Unger and Slaughter, 1964) it is evident that the data base is essential. It must also be noted whether the estimations are based on number of appendicectomies (Hyams, 1968; Hewitt, Milner and Le Riche, 1969), or number of patients admitted or discharged. The present study is thought to be more reliable as the data base is patients discharged [as pathological-anatomical studies were not routinely performed, this might allow for some overestimations of 10–20% (Pantell and Irwin, 1979)].

The sex variation with female dominance in the age group 5–44 as reported previously (Lee, 1961; Metropolitan Life Statistical Bulletin, 1969; Pflanz, 1978) cannot be confirmed. Cultural or other factors (Georgakopoulos, 1974; Lee, 1961; Meyer *et al.*, 1964; Murphy, 1966) may seriously influence the estimates.

The third factor which may explain the reduction in incidence rates is the demographic changes which occur with a dramatic increase in the proportion of older people. As the incidence of appendicitis is low in the oldest, the demographic changes may reduce the crude incidence of the disease. Although it is impossible, as also reported by Arnbjørnsson *et al.* (1982) to account for the whole reduction in incidence on the basis of demographic changes alone, we suggest that for appropriate international comparison, age and sex dependent incidence rates should be used.

The mortality rates found in this study of 0·46–0·55% for male and 0·14–0·15% for females (0·30–0·37% for both sexes) depending upon the method of estimation are comparable to death rates from other countries (Department of Health and Social Security, 1974; Lee, 1961; Peltokallio and Jauhiainen, 1970; Peltokallio and Tykkä, 1981), but lower than mortality rates found in Germany (Lichtner and Pflanz, 1971) and U.S.A. (Metropolitan Life Statistical Bulletin, 1969). As pointed out by Lichtner and Pflanz (1971) the high death rate in Germany may be reduced if the rate of appendicectomies (accepting that many appendicectomies are performed for other diseases/disorders than acute appendicitis) decreases. That men have higher death rates than women is supported by data from the U.S.A. (Metropolitan Life Statistical Bulletin, 1969).

The consumption of hospital resources for this disease is also low, with 1·2% of all hospital discharges. This is lower than figures from England and Wales (Department of Health and Social Security, 1973; West and Roberts, 1974). It is interesting that patients with appendicitis need 30–40% of the resources used for gastrointestinal diseases in certain age groups (Table 3). The differences in length of stay between different counties revealed in this study is of importance. If our data are extrapolated to the whole country of Norway (4·1 million inhabitants), the maximum difference in length of stay (5·4 *v.* 8·1 days) will indicate that up to 15,000 bed-days could be liberated if the lowest length of stay was adopted for the whole country. This potential gain in bed-days could be used for other diseases which at the present time have low priority. The need for a common policy among surgeons is mandatory even for such a 'simple' disease as appendicitis.

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