

# CHOLECYSTITIS AND CHOLELITHIASIS IN CHILDREN\*

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Diseases of the gall-bladder such as cholecystitis or cholelithiasis are considered to be rare in childhood. In a hospital series of gall-stone cases, Linnemann (1938) found one child as against 3,600 adults. Since then improvements in the methods of investigation and in the diagnostic aids have made earlier diagnosis of gall-stone disease possible. Arnsperger, Martin and Krempin (1960) observed a ratio of 1:460 between children and adults suffering from gall-stones.

At the Department of Paediatric Surgery of Kronprinsessan Lovisas Barnsjukhus in Stockholm, there has been a tendency towards an increase in the cases of cholecystitis and cholelithiasis in recent years. This may probably be due to the improved methods of diagnosis (Fig. 1).

A survey of the literature on gall-stone diseases in adults (Alvarez, Meyer, Rusk, Taylor, and Easton, 1923), revealed that in many cases the

patient had manifested symptoms ever since childhood without the correct diagnosis being established. In order to obtain a conception of cholecystitis and cholelithiasis in children, i.e. principally their symptomatology and the diagnostic difficulties involved, an analysis has been made of 60 children aged 6-15 years, operated upon at our hospital from January 1950 to April 1961. This represents the largest series ever published.

## History

The first case of gall-stones in a child was published by Gibson in 1734, who performed an autopsy in 1723 and found concretions in the gall-bladder and in the common bile-duct of a boy of 12 years of age whose chief symptoms had been abdominal pain, vomiting and acholic faeces.

In 1928, Potter presented the first comprehensive report. He described four cases of his own and 224 from the literature. In 1938 he collected a further 200 cases published by different authors and reported four additional personal cases.

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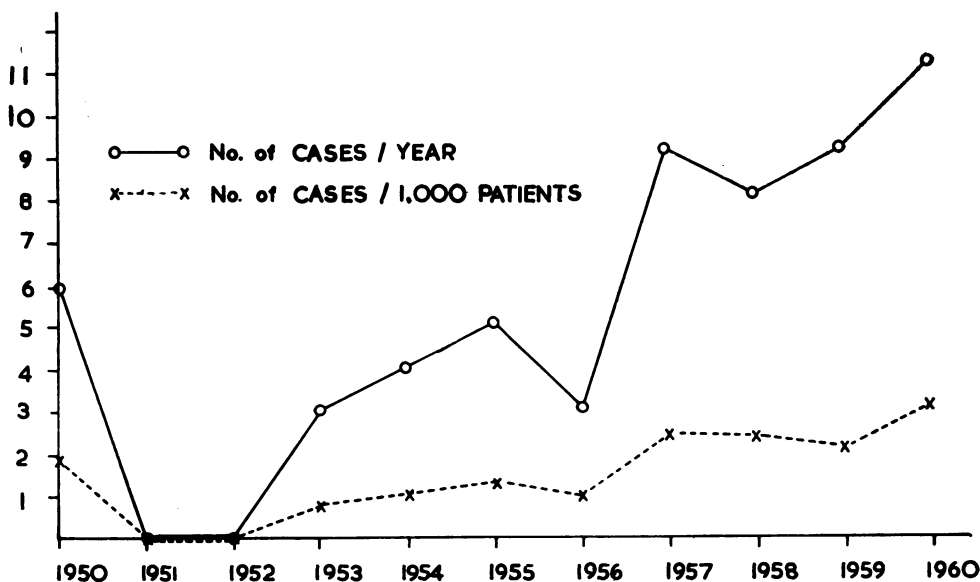


FIG. 1.  
174

Ulin, Nosal and Martin (1952) collected 30 new cases from the literature and at the same time made a critical analysis of Potter's cases. In their opinion, only 296 of Potter's cases could be regarded as definite manifestations of cholecystitis or cholelithiasis.

Up to 1960 a good 500 cases were described (Linnemann, 1938; Lindsten, 1939; Nathhorst, 1939; Lindén, 1944; Wilenius, 1951; Forshall and Rickham, 1954; Glenn and Hill, 1954; Kajiser, 1954; Babbitt, 1956; Bengmark and Rådberg, 1956; Ahrens, 1957a, b; Jensen, 1957; Walker, 1957; Seiler, 1960; and others). The majority of these publications refer to cases from the literature and only a few are the author's own. The experience gained earlier from cholecystitis and cholelithiasis in children can, therefore, be said to be based more on studies of the cases reported in the literature than on personal observations.

**Present Series**

**Composition.** Our series consists of 60 cases. In three of these haemolytic anaemias occurred simultaneously, while no clinical sign of this disease was to be seen in the remaining 57. There were 57 girls and three boys. The age varied from 6 to 15 years.

**Pathological Anatomy.** Acute cholecystitis with concretions was found in five cases. In 32 cases chronic cholecystitis was observed, 29 of these patients also having concretions. Concretions without any simultaneous signs of inflammatory changes were disclosed in 22 cases, and one case had only cholesterolosis. Concretions were found in the common bile-duct in four cases; these patients also had calculi in the gall-bladder. There was one case of acute pancreatitis (Table).

TABLE

Diagnosis	No. of Cases
Acute cholecystitis with calculi .. .. .	5
Chronic cholecystitis with calculi .. .. .	29
Chronic cholecystitis without calculi .. .. .	3
Cholelithiasis .. .. .	22
Calculi in common bile-duct .. .. .	4
Cholesterolosis .. .. .	1
Acute pancreatitis .. .. .	1

In three cases with chronic cholecystitis, malformations were observed, such as diverticula in the fundus of the gall-bladder. Two of these cases showed a communication between the diverticulum and the gall-bladder, while in the third case the diverticulum was closed and contained white bile and calculi.

In 40 cases, one of which had haemolytic anaemia, the colour of the stones was stated or they were chemically analysed. The main component of the gall-stones was cholesterol in 39 cases, while in the case of haemolytic anaemia the stones consisted of calcified bilirubin pigment.

**Symptoms.** The most common and important subjective symptom was abdominal pain. It was often difficult to analyse the nature and intensity of the pain, which was sometimes intermittent with more or less typical attacks resembling those in adults, and at other times more vague.

The localization of pain to below the right costal margin or to the epigastrium, typical of gall-stones, was noted in 47 patients on at least one occasion. Radiation of the pain to the back and up to the right shoulder was reported by 30 patients. Several children, mostly in the younger age groups, described pain in the periumbilical region or just diffusely in the abdomen. Even migration of the pain to the right lower quadrant was noted.

Pain in connexion with food was a symptom in 17 children. Some of them could not tolerate fatty foods, apples or eggs, while others felt pain after food in general.

Vomiting and nausea were common symptoms and occurred in 45 patients.

Obstipation was a coincident symptom in five patients.

As regards the objective symptoms, it may be mentioned that abdominal palpation was negative on some occasions in 24 children even in the course of an attack of pain. Tenderness under the right costal margin, with or without rigidity, was ascertained in 29 cases, and tenderness over MacBurney's point was found in 10. In two patients a tender mass could be palpated at the site of the gall-bladder.

Fever was noted in 19 cases, being moderate and not exceeding 38.6° C.

An increased sedimentation rate (i.e. more than 20 mm./hour) was recorded in 11 of the 44 cases in which this reaction was studied.

Jaundice, with the exception of the three patients who suffered from haemolytic anaemias, was observed or had occurred previously in three cases. In one of these, stones were found in the common bile-duct at operation, and in another case there was a widened common bile-duct without stones.

Radiological signs were the most important objective symptom. Cholecystography showed stones in the gall-bladder in 52 cases, while there was no contrast filling of the gall-bladder in eight cases.

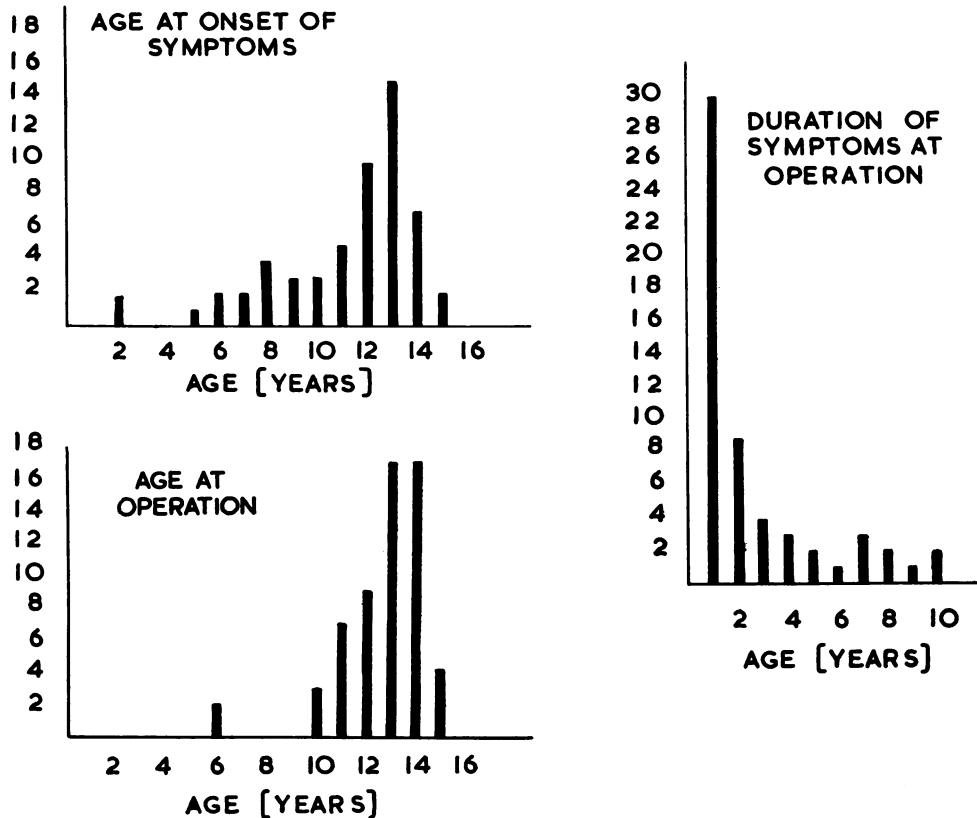


FIG. 2.

**Diagnosis and Differential Diagnosis.** In only half of our cases, i.e. 30 out of 60, did the symptoms directly indicate disease of the gall-bladder. In the other half, the symptoms were vague and not very conspicuous, being manifested for up to 10 years in several cases, without a correct diagnosis being established (Fig. 2).

On a suspicion of appendicitis, acute in six cases and chronic in four, 10 patients aged between 8 and 14 years had been subjected to surgery earlier. However, gall-bladder disease was found at operation in only one of these cases. That patient suffered from acute pancreatitis with fat necrosis. The other cases were gradually, owing to the recurrence of their symptoms, diagnosed by means of cholecystography.

Several small children localized the pain to the umbilical region, and this led to the diagnosis of umbilical colic in three girls. When they grew older the localization of the pain was restricted to the region of the right costal margin.

*Obstipation.* This was estimated to be the cause

of symptoms in two girls. They had uncharacteristic pain and no signs indicating any particular disease. When the pain increased or developed into attacks, cholecystography established the diagnosis.

*Dyspepsia.* Very transient abdominal pain and vomiting in one boy (mongol) and one girl aged 2 years were considered to be due to dyspepsia. Both children had recurring symptoms for 10 years before the correct diagnosis could be determined.

In a girl, aged 13, pain in the epigastrium and precordial region, and vomiting were interpreted as having a psychogenic origin, and the tentative diagnosis of anorexia nervosa was made as the patient had also lost weight. When she was later subjected to a typical gall-stone attack, the gall-bladder was examined by radiography.

*Abdominal Epilepsy.* This diagnosis is also met in these cases. One girl of 12 years had pain in the epigastrium that lasted for a couple of hours. She was admitted to hospital without this leading to any orientation of the cause of her symptoms. After

an acute attack of pain a year later cholecystography was undertaken.

Intermittent abdominal pain and vomiting were interpreted as manifestations of transient intestinal obstruction in two girls, aged 13 and 14, who had had appendectomies earlier. Owing to a repeated recurrence of symptoms, and as a plain radiograph of the abdomen gave no indications of intestinal obstruction, cholecystography was undertaken.

*Hepatitis.* This was considered to be the reason for fatigue, abdominal pain and jaundice in a girl of 11 years of age, as cholecystography gave negative findings. Renewed cholecystography a few months later, owing to a recurrence of her symptoms, revealed concretions in the gall-bladder.

**Treatment and Prognosis.** Treatment was surgical in all cases. Cholecystectomy was performed in 59 cases. In one case with simultaneous haemolytic anaemia, cholecystotomy was the procedure adopted. The three patients with haemolytic anaemias were subjected to splenectomy at the same stage. No deaths were recorded.

There were no complications in connexion with the operation on the gall-bladder. This applies also to the postoperative course in the three cases of simultaneous splenectomy. Strangulation by a band occurred in one case two months after cholecystectomy. Surgery was performed and the patient has since been free from symptoms.

### Results

All patients were subjected to a follow-up examination and 13 stated that they had had some symptoms after operation. In four cases, less than a year had elapsed since the operation and it was, accordingly, too early to judge the final results. Of the remaining nine patients, six mentioned that after eating fatty foods they occasionally felt moderate inconvenience in the abdominal region. The other three patients reported that they sometimes had attacks of pain similar to those prior to operation. Only one patient had severe enough symptoms to apply to a doctor spontaneously. The patient on whom only cholecystotomy was performed had been free from symptoms. Cholecystography 11 years after surgery was negative.

### Discussion

The aetiology of cholecystitis and cholelithiasis is as uncertain in children as in adults. However, certain factors seem to be of greater significance in children.

Malformations, such as stenosis and diverticulum

that hinder the discharge of bile are considered to be found more often in children than in adults (Gehwolf, 1925; Gross, 1936; Bogatko and Mehlman, 1947; Matteson, 1949; Walker, Field and Conen, 1960). In 1954, Forshall and Rickham found stenosis of the cystic duct in three of their six cases. No such stenosis was observed in the present series, but there were three cases with diverticula. In one of them the diverticulum was closed and contained stones.

Blood diseases, e.g. haemolytic anaemia and sickle cell anaemia, which are characterized by an increased degeneration of the red blood corpuscles, are considered to predispose towards gall-stones (Mintz, Church and Adams, 1955). Gross (1953) stated that haemolytic anaemia was the most common cause of gall-stones in children. The present series constitutes no support for his theory, as haemolytic anaemia was present in only three of our 56 cases with calculi.

Infection is singled out in the literature as being of particular significance in children (Sterling, 1939; Wilenius, 1951; Bonta and Lovingood, 1952; Glenn and Hill, 1954; Jensen, 1957; Arnspiger *et al.*, 1960; Tornai, Lükö and Kereszturi, 1960). This supposition does not gain support in our series. Not a single case of our 37 cases of cholecystitis has been found to have any connexion with infection before the onset of gall-bladder disease.

Parasites, e.g. *Ascaris lumbricoides*, have been reported by Bonniot and Lacroart (1945) as a cause of cholecystitis in children. The present series contains no such cases.

Metabolic disturbances seem to be of importance in children as well as in adults suffering from cholelithiasis (Seiler, 1960).

The body weight in the present series was strikingly high, in the majority of cases exceeding the normal limits of the respective age groups (Fig. 3). It was often stated in the case history that the patient was plump.

No detailed analyses were performed in our series regarding cholesterol metabolism. The concentration of cholesterol in the blood was measured in only six cases, two of which gave increased values.

The role of heredity has been emphasized by some authors (Seiler, 1960) and refuted by others (Glenn and Hill, 1954). In our series there is no statistically significant difference as regards heredity between the patients suffering from diseases of the gall-bladder and 60 other patients from the same hospital.

The sex incidence, which in adults is marked by a strong predominance of the female sex, has varied as regards children among different authors. Thus, Ulin *et al.* (1952) found, in their survey of 326 cases,

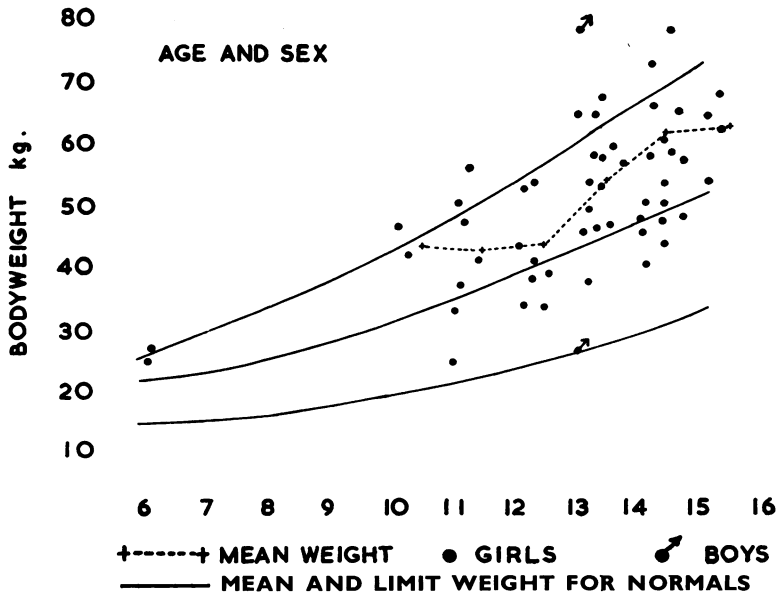


FIG. 3.

a predominance of boys in a ratio of 3:2. On the other hand, Forshall and Rickham (1954) reported six cases who were all girls. Walker (1957), described nine cases, five of whom were girls. Seiler (1960), published eight cases, six of whom were girls. Our own cases showed a great predominance of the female sex, i.e. 57 girls and three boys. Of these three boys, one suffered from haemolytic anaemia, another was a mongol, and the third boy weighed 80 kg. at the age of 13 years. This predominance of the female sex in children gives a ratio of 19:1, which even exceeds that generally found in adults, the ratio there being 4:1.

The age incidence is evident from Figs. 2 and 3. The majority of the patients were above 10 years of age at operation, only five being 10 or younger. The two youngest patients were 6 years old. The median age was 13 years. The literature contains reports of cholecystitis and cholelithiasis in infants also (Skemp, 1931; Glenn and Hill, 1954; Krebs, 1954; Tornai *et al.*, 1960). In 1960, Arnspiger *et al.* described a case of cholecystitis in a boy 17 days old. Cholecystitis and cholelithiasis have been observed in foetuses also (Mitchell, 1927).

**Diagnosis.** The difficulty of establishing the correct diagnosis in acute abdominal conditions in children is well known. Ekström and Nylander (1961) reported an analysis of about 900 children submitted to appendectomy at Kronprinsessan Lovisas Barnsjukhus. They found faulty diagnoses

in 30% when appendicitis was suspected. In the same investigation, in a group of patients operated upon because of recurrent abdominal pain or other reasons where there were no pre-operative suspicions of appendicitis, 30% proved to have a manifest appendicitis. The same difficulties seem to be encountered in cholecystitis and cholelithiasis in children. In the present series, disease of the gall-bladder was suspected initially in half the cases. In the other half up to 10 years elapsed before the correct diagnosis could be determined (Fig. 2).

The difficulties of diagnosis are probably due partly to the fact that children often cannot describe their symptoms and partly to their localizing the pain to the umbilical region.

Thus, the nature of the pain and its localization are of but little significance with regard to diagnosis.

The connexion between pain and food also plays a small part in this respect, being a rarely identified symptom (Ahrens, 1957a, b). Only 17 cases occur in our series.

Palpation of the abdomen may give valuable information, when tenderness, with or without rigidity, is located below the right costal margin. However, in our series there were 24 patients lacking this typical tenderness, even in the very course of an attack of pain.

Laboratory examinations are of little significance, although Ulin *et al.* (1952) recorded a frequency of jaundice in children suffering from disease of the gall-bladder of 26-45%, while in adults jaundice

occurs in only 8-10%. Jaundice is rare, however, in the present series, being manifested only in three cases (1/19), with the exception of the cases who had haemolytic anaemia.

Cholecystography seems to be the best diagnostic aid. All the cases gave positive radiological findings. In two cases cholecystography was at first negative, but renewed radiography a few months later gave positive findings.

It seems as though cholecystography should be performed in cases with indefinite abdominal pain, particularly in girls over 10 years of age who are principally liable to the diseases in question, seeing that there are no other methods available to determine the cause of the patient's symptoms.

**Treatment.** The treatment should be surgical in cholecystitis and cholelithiasis, and cholecystectomy should be the normal procedure.

Some authors have only recommended cholecystectomy on children suffering from cholelithiasis, provided there are no inflammatory changes in the wall of the gall-bladder (Chiray, Debray and Delattre, 1950; Gross, 1953; Grob, 1957). Experience with adults shows, however, that the gall-stone disease in these cases often recurs and requires renewed operation. This has been reported also from observations on children who have been subjected to cholecystectomy (Edington, 1930; Barnes, 1958).

In our opinion, gall-stone disease in children in the age group referred to in the present series does not in any essential way differ from that manifested in the higher age groups. Consequently, it seems reasonable to adopt the same methods of treatment as in adults. However, it should be observed that in the only case of cholecystectomy in our series, cholecystography 11 years after operation gave negative findings.

There were no noteworthy problems in removing the gall-bladder in our cases. Complications such as biliary dyskinesia were noted in only three of 59 children.

### Summary

At Kronprinsessan Lovisas Barnsjukhus during the period January 1950 to April 1961, 60 children with cholecystitis and/or cholelithiasis were operated upon. The series is larger than any series reported earlier.

The ages ranged from 6 to 15 years.

There were 57 girls and three boys. The predominance of females to males is greater than that found in adults.

Haemolytic anaemia was an uncommon cause of cholelithiasis and occurred in three patients.

Malformations of the gall-bladder were found in three cases.

Body weight above the normal was a common finding in the series.

No hereditary factor could be traced.

Infection as a cause of cholecystitis was not found.

Abdominal pain was the most common symptom. In many cases it was of an indefinite nature. The localization of the pain to the right costal margin was found on at least one occasion in 47 patients. Several patients, mostly in the younger age groups, localized the pain to the periumbilical region.

Pain in connexion with food was seldom found.

Jaundice was observed in three patients, apart from those having haemolytic anaemias.

The principal diagnostic aid was radiography.

The diagnosis was fairly easily established in half of the cases. In some the symptoms persisted for up to 10 years before correct diagnosis was made. The abdominal pain had earlier led to operation for suspected appendicitis in 10 cases with the establishment of the correct diagnosis in one case.

Cholecystography is recommended for children, particularly girls over 10 years of age, if the cause of the indefinite abdominal symptoms is elusive.

The treatment was surgical in all cases. In 59 cases cholecystectomy was performed and in one case cholecystotomy.

There were no deaths and no postoperative complications.

Cholecystectomy is the operative procedure recommended in every case. In cholelithiasis there is a risk of a recurrence of calculi if cholecystotomy only is performed.

There were no noteworthy disadvantages in removing the gall-bladder in a child. At the follow-up examination, three out of 59 cholecystectomized patients disclosed symptoms such as moderate biliary dyskinesia.

### REFERENCES

- Ahrens, W. E. (1957a). Cholelithiasis and cholecystitis in infancy and childhood. A Review. *Clin. Proc. Child. Hosp. (Wash.)*, 13, 85.  
 — (1957b). Gall bladder disease in children: Four case reports. *ibid.*, 13, 94.  
 Alvarez, W. C., Meyer, K. F., Rusk, G. Y., Taylor, F. B. and Easton, J. (1923). Present-day problems in regard to gallbladder infections. A statistical inquiry. *J. Amer. med. Ass.*, 81, 974.  
 Arnspiger, L. A., Martin, J. G. and Krempin, H. O. (1960). Acute non-calculous cholecystitis in children. *Amer. J. Surg.*, 100, 103.  
 Babbitt, D. P. (1956). Gallstones in children. *Amer. J. Dis. Child.*, 92, 5.  
 Barnes, F. E. (1958). Cholecystitis in a four year old child. *Amer. J. Surg.*, 95, 1013.  
 Bengmark, S. and Rådberg, C. (1956). Cholelithiasis hos 18 månaders gosse. *Nord. Med.*, 55, 88.  
 Bogatko, F. H. and Mehlman, J. (1947). Cholecystitis and cholelithiasis in a congenital diverticulum of the gall bladder in a three-year-old boy. *J. Pediat.*, 31, 75.  
 Bonniot, A. and Lecroart, F. (1945). Accidents biliaires de l'ascaridiase. *Lyon chir.*, 40, 742.

- Bonta, J. A. and Lovingood, C. G. (1952). Acute cholecystitis in childhood. *Surgery*, 31, 309.
- Chiray, M., Debray, Ch. and Delattre, P. (1950). La lithiase biliaire des jeunes. *Acta gastro-ent. belg.*, 13, 89.
- Edington, G. H. (1930). After-history of case of gall-stones in a young subject. *Brit. med. J.*, 1, 782.
- Ekström, G. and Nylander, I. (1961). Appendectomy of children with nervous abdominal pain. *Acta Paedopsychiat. (Basel)*, 28, 210.
- Forshall, I. and Rickham, P. P. (1954). Cholecystitis and cholelithiasis in childhood. *Brit. J. Surg.*, 42, 161.
- Gehwolf, S. (1925). Ein Beitrag zur Cholezystitis mit Cholelithiasis beim Kinde. *Münch. med. Wschr.*, 72, 99.
- Gibson, J. (1734). An extraordinary large gall-bladder and hydropich cystis. In *Medical Essays and Observations* (revised first edition). [Royal Society of Edinburgh], 2, 352.
- Glenn, F. and Hill, M. R. (1954). Primary gallbladder disease in children. *Ann. Surg.*, 139, 302.
- Grob, M. (1957). *Lehrbuch der Kinderchirurgie*. Thieme, Stuttgart.
- Gross, R. E. (1936). Congenital anomalies of the gallbladder. *Arch. Surg. (Chicago)*, 32, 131.
- (1953). *The Surgery of Infancy and Childhood*. Saunders, Philadelphia and London.
- Jensen, F. (1957). Galdesten hos børn. *Ugeskr. Læg.*, 119, 764.
- Kaijser, A. (1954). Om gallsten hos barn. *Svenska Läk.-Tidn.*, 51(1), 871.
- Krebs, H. (1954). Zur Pathogenese der Cholelithiasis mit Pankreasbeteiligung im frühen Kindesalter. *M Schr. Kinderheilk.*, 102, 327.
- Lindén, K. (1944). Gallensteine bei Kindern. *Acta chir. scand.*, 89, 446.
- Lindsten, M. (1939). Fall av cholelithiasis hos 11-åring. *Nord. Med.*, 2, 1224.
- Linnemann, W. (1938). Gallensteine bei Jugendlichen. Inaug. Dissert., Leipzig.
- Matteson, S. (1949). Cholelithiasis in childhood. *J. Pediat.*, 34, 777.
- Mintz, A. A., Church, G. and Adams, E. D. (1955). Cholelithiasis in sickle cell anemia. *ibid.*, 47, 171.
- Mitchell, J. F. (1927). Quoted by Potter, A. H. (1928). Gall-bladder disease in young subjects. *Surg. Gynec. Obstet.*, 46, 806.
- Nathhorst, H. (1939). Gallensteine bei Kindern. *Acta paediat. (Uppsala)*, 26, 319.
- Potter, A. H. (1928). Gall-bladder disease in young subjects. *Surg. Gynec. Obstet.*, 46, 795.
- (1938). Biliary disease in young subjects. *ibid.*, 66, 604.
- Seiler, I. (1960). Gallbladder disease in children. *Amer. J. Dis. Child.*, 99, 662.
- Skemp, A. A. (1931). Gallstones in infancy. *J. Amer. med. Ass.*, 96, 108.
- Sterling, J. A. (1939). Bacterial agglutinin in bile of patients with cholelithiasis. *Surgery*, 5, 865.
- Tornai, A., Lükö, G. and Kereszturi, A. (1960). Cholecystitis im Säuglings- und Kindesalter. *Ann. paediat. (Basel)*, 194, 216.
- Ulin, A. W., Nosal, J. L. and Martin, W. L. (1952). Cholecystitis in childhood: associated obstructive jaundice. *Surgery*, 31, 312.
- Walker, C. H. M. (1957). Aetiology of cholelithiasis in childhood. *Arch. Dis. Childh.*, 32, 293.
- Walker, G. R., Field, P. and Conen, P. E. (1960). Cholelithiasis associated with congenital malformation of the cystic duct in a young child. *Brit. J. Surg.*, 48, 78.
- Wilenius, R. (1951). Cholecystitis and cholelithiasis in childhood. *Ann. Chir. Gynaec. Fenn.*, 40, 135.