

นิพนธ์ต้นฉบับ

Original Article

Diagnostic Value of the Routine Plain Film in Children with Acute Non-Traumatic Abdominal Pain

โอกาสพบความผิดปกติจากฟิล์มเอกซเรย์ช่องท้องในกรณีผู้ป่วยเด็กที่มีอาการปวดท้องที่ไม่ได้เกิดจากอุบัติเหตุ

Luckana Jirapongsa, M.D.

ลักษณา จิราพงษ์ พ.บ.

Paiboon Liblub,

ไพบูลย์ ลิบลับ เจ้าหน้าที่รังสีการแพทย์

Rabeab Thongpan

ระเบียบ ทองแ忿 เจ้าหน้าที่รังสีการแพทย์

Division of radiology

กลุ่มงานรังสีวิทยา

Prachuabkirikhan Hospital

โรงพยาบาลประจวบคีรีขันธ์

ABSTRACT

Objective 1. to assess diagnostic value of all films and compared individual films in the routine abdominal radiographs in children with acute non traumatic abdominal pain.
 2. to determine correlation between the sex, age, associated symptom, underlying disease, severity of the physical examination and diagnostic plain film.

Materials and methods During October 2002 to January 2007, 72 patients with acute abdominal pain were examined. The diagnostic value, the compared individual value of routine abdominal radiographs and the correlation between each variable as age, sex, onset of pain, associated symptom, underlying disease and severity of physical examination are determined.

Results The diagnostic value of the routine plain abdomen radiographs is about 31.9% with individual diagnostic value of the supine view about 80.7%. There is no correlation between the sex, age, associated symptom, underlying disease, severity of the physical examination and diagnostic plain film.

Conclusion The diagnostic value of the routine plain film in children with acute non traumatic abdominal pain is about 31.9%. In each plain radiograph, the supine film is the cardinal film. There is no any factors influence to the diagnostic value of the plain radiographs.

Key words : acute nontraumatic abdominal pain, plain film, acute abdomen in children.

บทคัดย่อ

การศึกษาข้อมูลในผู้ป่วยเด็กที่มีอาการปวดท้องที่ไม่ได้เกิดจากอุบัติเหตุ ที่ได้รับการเอกซเรย์ช่องท้องที่แฝงกับผู้ป่วยนอกและอุบัติเหตุอุกเฉินในโรงพยาบาลประจำวันครึ่งปี ตั้งแต่ตุลาคม 2545 ถึงมกราคม 2550 จำนวนทั้งสิ้น 72 คน โดยทำการศึกษาโอกาสที่จะพบความผิดปกติเบรี่ยบเทียบ กับในกรณีศัลยกรรม และอายุรกรรม รวมทั้งศึกษาความสัมพันธ์กับความผิดปกติอื่นได้แก่ อายุ เพศ เวลา 以便 ถึงอาการปวดท้อง อาการอื่นร่วม โรคพื้นฐาน และอาการแสดง พบว่า โอกาสที่จะพบความผิดปกติจากเอกซเรย์ช่องท้องที่พบร้อยละ 31.9 โดยพบในกรณีศัลยกรรม มากกว่า อายุรกรรม เกือบ 2 เท่า และเมื่อเปรียบเทียบความชัดเจนระหว่างฟิล์มท่านอน ท่านั่ง และเอกซเรย์ปอด พบว่า ฟิล์มท่านอนเพียงท่าเดียวสามารถช่วยในการวินิจฉัยโรคได้ถึงร้อยละ 80 สำหรับเอกซเรย์ปอดนั้น ในการศึกษานี้ อาจพบความผิดปกติเพียงร้อยละ 19 แต่ยังมีความสำคัญมากในแง่การคัดกรองก่อนการผ่าตัด

Introduction

Abdominal pain is a common presenting symptom in children at the emergency room. Children may present with an acute episode, chronic or recurrent pain.¹⁻³ There is diagnostic dilemma for evaluation whether surgical condition or not. In general, the abdominal pain can be diagnosed through the history, physical examination and proper investigation.

Age is a key factor as shows differential diagnosis as described below;⁴⁻⁶

Six to eleven years

- Gastroenteritis
- Appendicitis
- Constipation
- Functional pain
- Urinary tract infection
- Trauma
- Pharyngitis

Twelve to eighteen years

- Appendicitis
- Gastroenteritis
- Constipation
- Dysmenorrhea
- PID
- Abortion/ectopic pregnancy
- Ovarian/testicular torsion

The most common medical cause is gastroenteritis and the most common surgical cause is acute appendicitis. But due to limitation in communication, the investigation is crucial. Often the plain abdominal radiographs are performed routinely as the initial investigation. The diagnostic value of the plain radiographs is quite questionable and very often there is no clear indication.⁷ The recommendation for routine plain radiographs are at least supine and upright films and may be including chest films as acute abdomen series. The additional films

Birth to one year

- Infantile colic
- Gastroenteritis
- Constipation
- Urinary tract infection
- Intussusception
- Volvulus
- Incarcerated hernia
- Hirschsprung's disease

Two to five years

- Gastroenteritis
- Appendicitis
- Constipation
- Urinary tract infection
- Intussusception
- Volvulus
- Trauma
- Pharyngitis

as lateral decubitus are occasional requested.

The radiation exposure of the abdomen radiograph is about 50 times as compared to the chest film.⁸ In children, the radiation exposure can induce mutation. So lesser amount of radiation exposure causes less opportunity to mutate cells especially dividing cells. The independent value of the plain radiograph is evaluated for decreasing number of abdominal films which will decrease radiation exposure.

This study aims to assess diagnostic value of the routine plain film in children with acute abdominal pain and determines correlation between the sex, age, associated symptom, underlying, severity of the physical examination and diagnostic plain film. This study also assesses independent value to each routine plain film.

Materials and Methods

Routine radiographs of 72 children patients with non-traumatic abdominal pain in the emergency and Outpatient Department of Prachuabkirikhan Hospital during October 2002 to January 2007 were retrospectively reviewed. All radiographs were obtained in at least one view of the plain radiographs as supine, upright and chest films. The clinical information was reviewed from medical records.

The radiographic assessment was interpreted and placed in categories as

- Normal finding.
- Abnormal finding but not diagnostic such as localized bowel dilatation at mid abdomen, nonspecific bowel dilatation, etc.
- Abnormal finding and diagnostic such as

dilatation of the proximal bowel loop with loss of rectal gas, representing in gut obstruction. Then assess diagnostic value of the plain radiograph.

The Spearman's rank correlation coefficients at $p < 0.005$ and the logistic regression was used to determine correlation between each variable as age, sex, onset of pain, associated symptom, underlying disease and severity of physical examination (mild tender, generalized tender and guarding).

Results were analyzed using SPSS version 11.5. The confidence intervals of 95% and p -value of < 0.05 were considered statistically significant.

Interpretation made independently for each radiograph in the routine abdominal radiographs. They were categorized to be

1. Valuable of supine film superior and equal to the upright film.
2. Valuable of supine film inferior to the upright film.
3. Valuable of the chest film.

The independent diagnostic value of each plain film is determined.

Results

72 children patients with non-traumatic abdominal pain were identified. The age ranged from 1 day to 15 years and the mean age was 5.35 years. There are 61.1% male ($n = 44$) and 38.9% female ($n = 28$). There are 68.1% surgical cases ($n = 49$) and 31.9% medical cases ($n = 23$).

In all cases, there are 14/72 normal plain film (19.4%), 35/72 abnormal plain film with not diagnosis (48.6%), and 23/72 abnormal plain film with diagnosis (31.9%).

Abnormal finding	No of films	Foreign body	2
		Ascites	1
Focal bowel dilatation	24		
Generalized bowel dilatation (bowel ileus)	20		
Nonspecific bowel gas pattern	16		
A lot of fecal retention	6		
Soft tissue mass	6		
Gut obstruction	3		
Hepatic or splenomegaly	3		

There is no correlation by each variable as age, sex, onset of pain, associated symptom, underlying disease and severity of physical examination (mild tender, generalized tender and guarding) and the diagnostic plain film by using Spearman's rank correlation coefficients at $p < 0.005$ and logistic regression.

Table 1 Shows number of patients with non-diagnosis and diagnosis by plain film in both medical and surgical cases.

Plain films	Diagnostic cases (%)		Total
	Medical case	Surgical case	
Normal plain film	12 (85.7%)	2 (14.3%)	14
Abnormal plain film with not diagnosis	30 (85.7%)	5 (14.3%)	35
Abnormal plain film with diagnosis	7 (30.4%)	16 (69.6%)	23
Total	49	23	72

There are 52 patients with two views plain radiographs, supine and upright views and only 26 patients with acute abdominal series. (Including supine, upright and chest film). Then compares diagnostic value in each plain radiographs as described below ;

Discussion

Abdominal pain is one of the most common symptoms in medical emergency. The diagnosis mainly obtains from the history and physical examination. In children, there is limitation in communication. The plain radiograph is one of the preli-

Table 2 Individual value of the supine, erect abdomen and chest radiographs

Condition	No of patients
Supine is worse than the erect	10/52 (19.23%)
Supine is equal and better to the erect	42 /52(80.77%)
Only in chest film	5/26 (19.23%)

minary investigations.

Eisenberg et al presented only 10% in 1780 examinations of abdominal X-rays contained abnormality.⁹ Brewer et al found about 38% abnormality from 427 emergency-room patients abdominal X-rays in acute abdomen and about one-third provide specific diagnosis.¹⁰ Stower et al found that only 15.5% patient with diagnostic abdominal plain film but little effect on the management.¹¹

In this study, there are about 23 cases (31.9%) diagnoses by plain radiographs. This quite differs from the previous study. It may be due to more strictly in criteria for requesting abdominal radiograph than the previous study. The diagnostic value of plain radiographs of this study are 16 surgical cases (69.9%) and 7 medical cases (30.4%). This implies that the plain radiographs are still crucial for diagnosis surgical cases.

Eisenberg et al stressed that normal plain film does not rule out intra-abdominal pathology.⁹ This study also supports in this and shows that 2 in 23 surgical patients (14.3%) presenting with normal plain film. The two cases are partial gut obstruction and acute cholecystitis.

So in clinical suspicious for surgical case, further investigation is highly recommended.

Eisenberg et al attempted to develop criteria for requesting abdominal X rays that perform in patients with moderate, severe abdominal tenderness, with suspicious bowel obstruction, renal/ureteric calculi, ischemic, gallstones.⁹ But in this study, there is no correlation by each variable as age, sex, onset of pain, associated symptom, underlying disease, severity of physical examination (mild tender, generalized tender and guarding) and the diagnostic plain film by using Spearman's rank correlation coefficients at $p < 0.005$ and logistic regression. The too small sample size may be a reason.

Except for the cost-benefit consideration, the radiation exposure of the abdomen radiograph is about 50 times as compared to the chest film,⁸ the malignancy or mutation risks must be realized. So lesser in number of films, there was lesser amount of radiation exposure. Stuart E. Mirvis et al concluded that the erect view of the abdomen could be eliminated from the standard abdominal series without loss of diagnostic information.¹²

In this study, the only supine film can lead

to diagnosis in 80% without using the erect film. It is emphasize that the erect film can be eradicated from the routine abdominal radiographs without influencing the diagnostic information. About the chest film, there is only 19.23% films lead to diagnosis but it is still very important. The plain chest film uses to assess the underlying status of the patient especially for pre-operation.

Conclusion

In acute non-traumatic abdominal pain in children, the plain radiograph is still the important preliminary investigation with diagnostic value about 31.9%, especially in surgical cases. There is no any factors influence to the diagnostic value of the plain radiographs with statistic significant. But the clinical information is still only the clue for requesting the plain abdominal radiographs. The cases with higher clinical suspicious for surgical condition, the investigation is higher recommended. The supine film is enough for diagnosis nearly 80% of cases. But negative abdominal plain film is not excluded the surgical condition. If clinical is suspicious, further investigation is advised. Even low diagnostic yield in acute abdominal pain patient, there is actually significant of the chest film, especially for pre-operative assessment.

Acknowledgement

There are indebted to the Radiographic, Emergency and Outpatient Department of the Prachuabkirikhan hospital for data collection and Mrs. Kulnita sungkua for statistic analysis.

Reference

1. Scholer SJ, Pituch K, Orr DP, Dittus RS. Clinical outcomes of children with acute abdominal pain. *Pediatrics* 1996 ; 98 : 680-5.
2. Apley J. The child with abdominal pain. 2nd ed, Blackwell Scientific Oxford : United Kingdom ; 1975.
3. Flisher DR, Hyma PE. Recurrent abdominal pain in child. *Seminars in gastrointestinal disease* 1994 ; 5 : 15-9.
4. Buchert GS. Abdominal pain in children : an emergency practitioner's guide. *Emerg Med Clin North Am* 1989 ; 7 : 497-517.
5. King BR. Acute abdominal pain. In : Hoekelman RA. *Primary pediatric care*. 3rd ed. St. Louis : Mosby, 1997 : 181-9.
6. Finelli L. Evaluation of the child with acute abdominal pain. *J Pediatr Health care* 1991 ; 5 : 251-6.
7. Campell JPM, Gunn AA. Plain abdominal radiograph and acute abdominal pain. *Br J Surg* 1988 ; 75 : 554-6.
8. Royal college of radiologists. *Making the best use of a department of clinical radiology*, guideline for doctors. 4th ed. London : Royal college of radiologist ; 1998.
9. Eisenberg RL, Heineken P, Hedcock MW, Federte MP, Goldberg MI. Evaluation of plain abdominal radiographs in the diagnostic of abdominal pain. *Ann Surg* 1983 ; 197 : 464-69.
10. Brewer RJ, Golden GT, Hitch DC, Redolf LE, Wangensteen SL. *Abdominal pain : an analysis of 1000 consecutive cases in a university hospital emergency room*. *Am Surg* 1976 ; 131 : 219-

24.

11. M J Stower, T Mikulin, JD Hardcastle, SS Amar, DM Kean. Evaluation of the plain abdominal X-ray in the acute abdomen. Journal of the Royal Society of medicine 1985 ; 78 : 630-3.

12. Stuart E. Mirvis, Jeremy W. R. Young, Bijan Keramati, Erinda S. McCrea, Robert Tarr. Plain film evaluation of patients with abdominal pain : are three radiographs necessary? AJR 1986 ; 147 : 501-3.