

### Comparison of intraabdominal pressure with Ranson's criteria in prognosis of acute pancreatitis

### Ranson kriteri ve intraabdominal basınç arasındaki ilişkinin akut pankreatitin prognozundaki yeri

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#### ABSTRACT

Intra-abdominal hypertension (IAH) and abdominal compartment syndrome has described in patients with severe acute pancreatitis, but its clinical impact remains unclear. The aim of the study was to assess whether increased intra-abdominal pressure affects clinical course in patients with acute pancreatitis and compare intra abdominal pressure with Ranson's criteria in the prognosis of acute pancreatitis.

The present study was conducted in Department of General Surgery at Himalayan Institute of Medical Sciences over a period of 12 months. All patients admitted in hospital with confirmed diagnosis of Acute Pancreatitis were included in study and were followed up by measurement of intra abdominal pressure (IAP) by intra-vesicular method at time of admission and daily monitoring of IAP for one week. The incidence of IAH (defined as intra-abdominal pressure >12 mmHg), occurrence of organ dysfunction and outcome of disease was studied and compared with Ranson's score.

The analysis included 65 patients, all patients were subjected Ranson's score and IAP monitoring. The comparison of both groups showed statically P value in pulmonary failure of 0.557, CVS failure of 0.634, renal failure of 0.504, pancreatic necrosis of 0.641, infected pancreatic necrosis of 0.799 and patient undergoing surgical management of 0.778. Statically values of ICU stay and mortality in the patients with IAH was similar as in Ranson's score. It was observed that there was a positive correlation between IAP and Ranson's score i.e. 0.92.

The IAP monitoring is useful, inexpensive, easy method and can be considered an independent prognostic marker for the evolution and complications of acute pancreatitis especially in developing countries.

**Keywords:** Abdominal compartment syndrome, acute pancreatitis, Ranson's criteria, prognosis.

#### ÖZET

İntraabdominal hipertansiyon (IAH) ve abdominal kompartman sendromu (AKS) şiddetli akut pankreatit olan hastalarda görülmekle beraber, klinik etkisi tam olarak ortaya konulmamıştır. Bu çalışmanın amacı IAH'un hastalığın klinik seyrini etkileyip etkilemediğini ve Ranson kriterleri ile ilişkisini ortaya koymaktır.

Çalışma Himalaya Enstitüsü Tıp Merkezindeki Genel Cerrahi Kliniğinde son bir yılda gelen hastalarla yapılmıştır. Pankreatit tanısı kesinleşen ve hastaneye kabul edilen hastalarda mesane içerisine yerleştirilen sonda vasıtasıyla bir hafta süreyle günlük basınç ölçümleri yapıldı. 12 mmHg üstü IAH olarak kabul edildi. Organ yetmezliği ve hasta çıkış verileri değerlendirildi.

Çalışmaya alınan 65 hastanın verileri çalışmaya dahil edilmiştir. P değeri pulmoner yetersizlik saptananlarda 0.557, kalp-dolaşım yetmezliği saptananlarda 0.634, böbrek yetmezliği olanlarda 0.504, pankreatik necroz gelişenlerde 0.641, enfekte pancreas nekrozu gelişenlerde 0.799 ve ameliyat yapılanlarda 0.778 olarak saptanmıştır. Basınç artışı ve Ranson kriterleri arasındaki ilişki 0.920 olarak ve anlamlı derecede yüksek bulunmuştur.

Sonuç olarak; İntraabdominal basın ölçümü ve izlenmesi faydalı, ucuz ve kolay uygulanabilen bir yöntem olup, özellikle gelişmekte olan ülkelerde şiddetli akut pankreatitin izlenmesinde yararlı bir yöntemdir.

**Anahtar kelimeler:** Abdominal kompartman sendromu, akut pankreatit, Ranson kriterleri, prognoz.

## INTRODUCTION

Severe acute pancreatitis (SAP) is a serious surgical disease with a mortality of 25%-40%. While mild cases are often successfully treated with conservative measures, such as NPO (nil per oral) and IV fluid rehydration, severe cases may require admission to the ICU or even surgery (often requiring more than one intervention) to deal with complications of the disease process (1).

Patients with SAP tend to have elevated intra-abdominal pressure (IAP), eventually leading to intra-abdominal hypertension (IAH)(2). IAH causes organ dysfunctions such as respiratory, circulatory and renal failure which is known as Abdominal Compartment Syndrome (ACS). About 11% of SAP patients suffer from complications of ACS. SAP patients complicated by ACS, a special type of pancreatitis, tend to have a mortality of 66.7% (3).

For predicting the prognosis of acute pancreatitis, there are several exhaustive scoring indices such as Ranson's criteria, APACHE II scoring system, Balthazar's score (CT Score), Glasgow's prognostic criteria modified by Imrie that have been used as predictors of survival (4). Ranson's criteria introduced in 1974 is a common prognostic tool for predicting the severity of acute pancreatitis (5).

Despite recent advances in the management of acute pancreatitis, it remains a disease with an unpredictable clinical course and significant morbidity and mortality. Very few studies especially in India have been conducted in relation to intra abdominal pressure monitoring in severe acute pancreatitis. Hence this study is designed to compare intraabdominal pressure with Ranson's criteria in the prognosis of acute pancreatitis.

The aim of the study was to assess whether increased intra-abdominal pressure affects clinical course in patients with acute pancreatitis and compare the result of IAP assessment with Ranson's Criteria in the prognosis of acute pancreatitis.

## MATERIAL AND METHOD

The prospective study was conducted in Department of General Surgery at Himalayan Institute of Medical Sciences, HIHT University, Dehradun, India over a period of 12 months. Patients admitted in the hospital with the diagnosis of Acute Pancreatitis confirmed clinically and supported by blood investigations and imaging techniques were included in the study and were followed up by measurement and grading of intra abdominal pressure (IAP) by intravesicular method at time of admission and daily monitoring of IAP for one week along with Ranson's scoring (5,6). Patients with associated pre-existing

other co morbidity factors, with neurogenic bladder and who refuse to consent were excluded from the study.

The abdominal pressures were indirectly determined by measuring urinary bladder pressure with a Foley's catheter. Patients were catheterized with a 16-gauge Foley's catheter. The bladder was drained completely and then filled with 100 ml of sterile saline through the Foley's catheter. The tubing of the collecting bag will be clamped. Then the catheter will be connected to a saline manometer. The symphysis pubis with the zero reference the pressure will be measured in centimeters of water at end-expiration. A conversion factor of 1.36 will be used to convert the pressure in centimeters of water into millimeter of Hg (Table 1 and 2).

Interpretation and analysis of obtained results were carried out by using standard tests of significance and SPSS (Statistical Package for Social Science) version 17.

**Table 1:** Grading of intra-abdominal hypertension (6).

Grade	AP (mm Hg)
I	2-15
II	6-20
III	1-25
IV	25

**Table 2:** Ranson's score (5).

Grade I (0 – 2)
Grade II (3 – 5)
Grade III (6 – 8)
Grade IV ( $\geq$ 9)

## RESULTS

This was a prospective study conducted between 1st March 2012 to 1st March 2013 in the Department of General Surgery, Himalayan Institute of Medical Sciences, HIHT University, Dehradun, India. Total number of patients included in the study was 65.

There were 18 patients in grade I, 18 patients in grade II, 12 patients in grade and 17 patients in grade IV. (Table 3). 65 patients were subjected to intra abdominal pressure monitoring and it was found that 54 patients had raised IAP and 11 patients had normal IAP. 83.07% of patients had raised IAP.

According to grading of intra abdominal hypertension, 9 patients belong to group I (16.66%), 16 patients belong to group II (29.67%), 11 patients belong to group III (20.37%), 18 patients {33.33%} belonged to grade IV i.e. above 25 mmHg. (Table 4).

**Table 3:** Scoring of severity of acute pancreatitis according to Ranson's criteria (n=65).

Ranson's score	No. of patients	%
Grade I (0 – 2)	18	27.69
Grade II (3 – 5)	18	27.69
Grade III (6 – 8)	12	18.46
Grade IV ( $\geq 9$ )	17	26.15

In Ranson's grade I patients, 55.55% had normal IAP. In Ranson's grade II patients, 83.33% had grade II IAP. In Ranson's grade III patients, 91.66% had grade III IAP and in Ranson's grade IV patients the incidence of grade IV IAP is 100%. (Table 5). Out of 65 of acute pancreatitis, patients 31 were admitted in ICU and 34 patients did not require ICU management.

On comparing the ICU stays in both the groups, the incidence of ICU admission was 94.44 % with grade IV IAP and 94.11% in grade IV Ranson's score. Unpaired t test of the data showed P value 1. By

conventional criteria, this difference is considered to be not statistically significant. (Table 6)

**Table 4:** Severity of acute pancreatitis according to grades of IAP (mmHg) (n=54).

IAP grade	No. of patients	%
Grade I (12-15)	9	16.66
Grade II (16-20)	16	29.62
Grade III (21-25)	11	20.37
Grade IV (>25)	18	33.33

On comparing the mortality in both the groups, the incidence of mortality was 94.44 % with Grade IV IAP and 88.88% in grade IV Ranson's score. Unpaired t test of the data showed P value 0.3215. By conventional criteria, this difference is considered to be not statistically significant. (Table 7)

On comparing the morbidity data between Ranson's group and IAP group there was no significant difference in the outcome of the patients (Table 8).

**Table 5:** Comparison between raised IAP and severity in Ranson's grades.

Ranson's grade	I (n=18)		II (n=18)		III (n=12)		IV (n=17)	
	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%
Normal (0-5)	10	55.55	1	5.55	0	0.00	0	0.00
Grade I (12-15)	7	38.88	2	11.11	0	0.00	0	0.00
Grade II (16-20)	1	5.55	15	83.33	0	0.00	0	0.00
Grade III (21-25)	0	0.00	0	0.00	11	91.66	0	0.00
Grade IV (>25)	0	0.00	0	0.00	1	8.33	17	100

**Table 6:** Comparison of ICU stays between IAP and Ranson's group.

IAP Grades (mmHg)	IAP n=54	ICU n=31	%	Ranson's score	Ranson n=65	ICU n=31	%	Unpaired t test, P value
Grade I (12-15)	9	3	33.33	Grade I	18	3	16.66	
Grade II (16-20)	16	7	43.75	Grade II	18	7	38.88	
Grade III (21-25)	11	4	36.36	Grade III	12	5	41.66	
Grade IV (>25)	18	17	94.44	Grade IV	17	16	94.11	

**Table 7:** Comparison of number of deaths between IAP and Ranson's group.

IAP (mmHg)	IAP Grades	IAP n=54	Death n=18	%	Ranson's score	Ranson n=65	Death n=18	%	Unpaired t test P, value
12-15	I	9	0	0.00	Grade I	18	0	0.00	
16-20	II	16	0	0.00	Grade II	18	0	0.00	
21-25	III	11	1	5.55	Grade III	12	2	11.11	
>25	IV	18	17	94.44	Grade IV	17	16	88.88	

It was observed that there was a positive Pearson's correlation significance between maximum IAP and Ranson's score. (Figure 1) The positive correlation between IAP and Ranson's score was significant at the 0.01 level (2-tailed) (Table 9). It

was also observed that as the grade of Ranson's score increases in patients of acute pancreatitis IAP grading also increases. Hence there is a positive correlation between Ranson's criteria and intra abdominal pressure monitoring in patients of acute pancreatitis.

Table 8: Comparison of morbidity data between Ranson's group and IAP group.			
Characteristics	Ranson's score (n=65)	IAP score (n=54)	P value
Pulmonary failure	46	45	0.557
CVS failure	42	40	0.634
Renal failure	46	46	0.504
Pancreatic necrosis	40	38	0.641
Infected pancreatic necrosis	4	4	0.799
Surgical management	5	5	0.778

Table 8: Correlation between maximal intra-abdominal pressure & Ranson's score in patients with severe acute pancreatitis.			
		Ranson's score	MAXIAP
Ranson's score	Pearson correlation	1	.929**
	Sig. (2-tailed)		.000
	N	65	65
MAXIAP	Pearson correlation	.929**	1
	Sig. (2-tailed)	.000	
	N	65	65

\*\* . Correlation is significant at the 0.01 level (2-tailed).

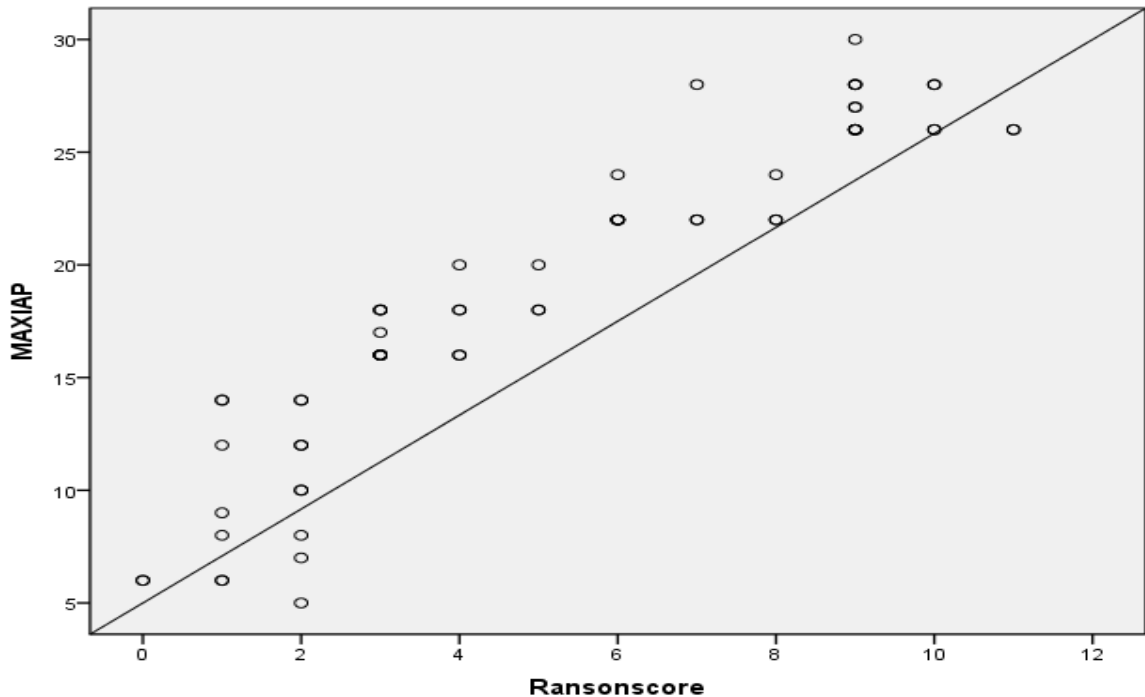


Figure 1: Pearson's correlation between maximum IAP and Ranson's score.

**DISCUSSION**

Severe acute pancreatitis (SAP) is a serious surgical disease with a mortality of 25-40%. World Society of the Abdominal Compartment Syndrome in 2006-07 concluded pancreatitis may be one of the commonest conditions leading to intra abdominal hypertension (6). Al-Bahrani concluded that intra-abdominal hypertension and ACS are frequent findings in patients with SAP and are associated with deterioration in organ function. Intra-abdominal pressure correlates with the severity of organ failure and a high admission IAP is associated with prolonged intensive care stay (7).

Out of 65 patients in our study who were subjected to intra abdominal pressure monitoring the incidence of raised IAP was 83.07%. De Waele, in 2009 observed that the incidence of intra-abdominal hypertension in patients with severe acute pancreatitis is approximately 60-80% and is usually an early phenomenon. (3) In our study Intra-abdominal is taken of every patient via trans-vesical route. IAP was taken for 7 days from the day of admission. The observation was that IAP is raised mainly in early course of event in acute pancreatitis, so if a patient had grade III IAH on day 2, the patient can be sent to intensive care for early initiation of the ICU care.

Ranson's criteria are the worldwide accepted prognostic scoring system of acute pancreatitis given in 1974 (5). Kron IL, Harman PK et al. in 1987 concluded that the measurement of bladder pressure using a standard transurethral bladder catheter provides an accurate determination of IAP (8). On comparison of our patients, 12 patients were of grade III Ranson's criteria; 1 of these 12 had grade IV intra abdominal hypertension (8.33%) & 11 had grade III intra abdominal hypertension. So the number of patients which were grade III according to Ranson's, they were also grade III according to Intra abdominal hypertension criteria. Out of total 65 patients, 17 patients were of grade IV Ranson's criteria. On comparing severity in Ranson's score and IAP grading 17 patients who had grade IV Ranson's also had grade IV severity according to intra abdominal pressure monitoring. So the number of patients which were grade IV according to Ranson's, they were also grade IV according to Intra abdominal hypertension criteria.

On comparing the ICU stays in both the groups, the incidence of ICU admission was 94.44% with Grade IV IAP and 94.11% in Grade IV Ranson's score. Unpaired t test of the ICU admission data showed P value 1, which is considered to be not statistically significant. So the patients going to ICU was similar and the grades in which they belong were also similar in both the criteria particularly with higher Ranson's score and IAP grades. Kimball defined elevated intra-abdominal pressure leads directly to progressive organ dysfunction in the intestinal, renal, pulmonary, cardio vascular and central nervous systems. Early detection of IAH allows the clinician to manage this condition with medical therapies. Progressive increase in IAP to levels above 20–25 mmHg, with associated organ failure usually requires surgical intervention (9). Schwarte, et al concluded that in the setting of SAP, pancreatic perfusion may also be affected contributing to the development of pancreatic hypoperfusion and eventually pancreatic necrosis (10). Bloomfield, et al. observed that pancreatitis can cause both IAH induced direct injury to the peritoneal or retroperitoneal space and also a massive systemic inflammatory response syndrome (11).

In our study the morbidity data between Ranson's group and IAP group there was no significant difference in the outcome of the patients. Unpaired t test of the mortality data showed P value 0.3215. By conventional criteria, this difference is considered to be not statistically significant. Pulmonary and renal failure was the most common cause of morbidity in both the groups with P value of 0.557 and 0.507 respectively. In our study on comparing the mortality in both the groups, the incidence of mortality was 94.44% with Grade IV IAP and 88.88% in Grade IV Ranson's score. Mole, et al., in 2009 concluded that extrapancreatic organ dysfunction is the key determinant of mortality in acute pancreatitis. Their present findings supported the primacy of pulmonary injury as the modal pattern of organ dysfunction in severe acute

pancreatitis, with increased frequencies of cardiovascular and renal compromise in fatal acute pancreatitis (12).

SAP patients develop IAH for several reasons. Pancreatic or retroperitoneal inflammation is the most obvious reason in the early course of the disease. Aggressive fluid resuscitation, resulting in generalized and visceral edema in particular, will add to the intra-abdominal volume during the first days of severe disease. Furthermore, paralytic ileus and peripancreatic acute fluid collections can also increase IAP. From the Ranson's scores of the patients, it seems that the more severe the disease, the higher the likelihood to develop IAH. But IAH itself may be an early predictor of severe disease, as elevated IAP seems to occur early in the course of the disease. IAH may even contribute to disease severity in patients with SAP (3).

It was also observed that there was a positive correlation between IAP and Ranson's score i.e 0.92. It was observed that as the grade of Ranson's increases in patients of acute pancreatitis IAP grading also increases. Hence there is a positive correlation between Ranson's criteria and Intra abdominal pressure monitoring in patients of Acute Pancreatitis and can replace the exhaustive and the investigative oriented Ranson's criteria.

Intra abdominal hypertension in patients with acute pancreatitis is an early event and is associated with organ dysfunction in the majority of patients. Since there is a positive correlation between Ranson's criteria and Intra abdominal pressure monitoring in patients of acute pancreatitis the intra abdominal pressure monitoring is an useful, inexpensive, easy and early prognostic marker of the evolution and complications of acute pancreatitis and can replace the exhaustive and investigative oriented Ranson's criteria especially in developing countries. Intra abdominal pressure monitoring can be considered an independent prognostic marker for the evolution and complications of acute pancreatitis.

## REFERENCES

1. Chatzicostas C, Roussomoustakaki M, Vardas E, Romanos J, Kouroumalis EA. Balthazar computed tomography severity index is superior to Ranson criteria and APACHE II and III scoring systems in predicting acute pancreatitis outcome. *J Clin Gastroenterol.* 2003;36:253-60.
2. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH. Acute pancreatitis: value of CT in establishing prognosis. *Radiology* 1990;174:331-336.
3. Jan J De Waele I. Intra-abdominal hypertension in patients with severe acute pancreatitis. *Crit Care* 2005;9(4):452-7.
4. Rossell C. History of the pancreas and the evolution of concepts and classification of pancreatitis. *Rev Gastroenterol Peru.* 2002;22(3):243-7.
5. Ranson JH, Rifkind KM, Roses DF, Fink SD, Eng K, Spencer FC. Prognostic signs and the role of

- operative management in acute pancreatitis. *Surg Gynecol Obstet* 1974;139:69-81.
6. Malbrain ML, Cheatham ML, Kirkpatrick AW, et al. Results from the international conference of experts on intra-abdominal hypertension and abdominal compartment syndrome. I. Definitions. *Intensive Care Med* 2006;32:1722-32.
  7. Al-Bahrani. Clinical relevance of intra-abdominal hypertension in patients with severe acute pancreatitis. *Pancreas*, 2008;36(1):39-43.
  8. Kron IL, Harman PK, Nolan SP. The measurement of intra abdominal pressure as a criterion for abdominal re-exploration. *Ann Surg* 1984;199:28-30.
  9. Kimball EJ. Intra-abdominal hypertension and the abdominal compartment syndrome: 'ARDS' of the gut. *Int J Intensive Care*. 2006;1:31-39.
  10. Schwarte LA, Scheeren TW, Lorenz C, De Bruyne F, Fournell A. Moderate increase in intraabdominal pressure attenuates gastric mucosal oxygen saturation in patients undergoing laparoscopy. *Anesthesiology* 2004;100:1081-1087.
  11. Bloomfield G, Saggi B, Blocher C, Sugerman H. Physiologic effects of externally applied continuous negative abdominal pressure for intra-abdominal hypertension. *Trauma* 1999, 46:1009-1014.
  12. Damian J Mole, Bayanne Olabi, Victoria Robinson, O James Garden, and Rowan W Parks HPB (Oxford). Incidence of individual organ dysfunction in fatal acute pancreatitis: analysis of 1024 death records. 2009; 11(2): 166–170.