DYNAMIC ILEUS IN SPINAL CORD INJURY

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Keywords: *spinal cord injury, dynamic ileus*

Abstract: *The aim is to evaluate dynamic ileus occurrence in patients with spinal cord injury (SCI). Method: a retrospective study was conducted during January 2006 - December 2007. Results: from the total number of 111 patients with SCI, 78.3% developed dynamic ileus. 60% of cases with dynamic ileus had cervical lesions, 36% thoracic and 4% lumbar. Frankel grade A patients provided 64.4% of cases of dynamic ileus, grade B 23%. Regarding time interval from SCI and ileus occurrence, 50% of patients developed this complication within 4-7 days, and 25% in 4 days. 12 cases had independent abdominal pathology or digestive complications occurred within traumatic context. Conclusions: SCI leads to multiple complications, including the important abdominal consequences. Ileus is an important pathological circumstance, frequently encountered in patients with high, severe SCI. The presence of dynamic ileus does not exclude the existence of a pre-existing abdominal pathology, which can be reactivated.*

Cuvinte cheie: *traumatism vertebromedular, ileus dinamic*

Rezumat: *Scopul este evaluarea apariţiei ileusului dinamic la pacienţii cu traumatisme vertebromedulare (TVM). Metodă: s-a efectuat un studiu retrospectiv în perioada ianuarie 2006 – decembrie 2007. Rezultate: din totalul de 111 pacienţi cu TVM, 78,3% au dezvoltat ileus dinamic. 60% din cazurile cu ileus dinamic au avut leziuni cervicale, 36% toracale şi 4% lombare. Pacienţii din clasa Frankel A au furnizat 64,4% din cazurile de ileus dinamic, clasa B 23%. Privitor la intervalul scurs de la TVM până la apariţia ileusului, 50% din pacienţi au dezvoltat această complicaţie în intervalul 4-7 zile, iar 25% sub 4 zile. În 12 cazuri a existat o patologie abdominală de sine stătătoare sau au survenit complicaţii în sfera digestivă în contextul TVM. Concluzii: TVM se soldează cu complicaţii multiple, între care cele abdominale ocupă un loc important. Ocluzia intestinală este o circumstanţă patologică gravă, frecvent întâlnită la pacienţii cu TVM înalte, severe. Prezenţa ileusului dinamic nu exclude existenţa unei patologii abdominale preexistente, care poate fi reactivată în noul context patologic.*

INTRODUCTION

Involvement of the digestive tract is a common consequence of severe pathology.(1-4) Politrauma, traumatic brain injury, spinal cord injury (SCI), burns, severe sepsis, are all accompanied by various gastrointestinal damages: upper gastrointestinal bleeding and perforation in the upper digestive tract by acute stress digestive lesions, dynamic ileus, through septic or neuro-miogenic mechanism, etc. SCI affect extrinsic (parasympathetic, sympathetic and somatic) innervation of the bowel. These affect the intestinal dynamics, to the parietal and smooth muscle microcirculation network, having serious functional consequences.(3-5)

PURPOSE OF THE STUDY

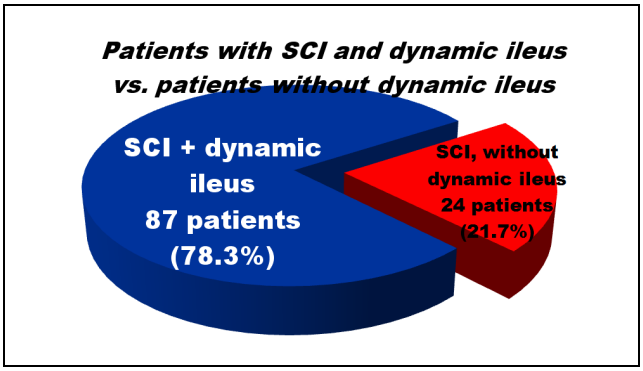
The aim is to evaluate dynamic ileus occurrence in patients with spinal cord injury (SCI). Method: a retrospective study was conducted during January 2006 - December 2007.

MATERIAL AND METHODS

Between January 2006 and December 2007 111 patients were admitted into the Emergency Clinical Hospital Bagdasar-Arseni, from Bucharest. 87 patients (78.3%) developed dynamic ileus, following SCI, having various degrees of severity,.

The present study is a retrospective analysis of a series of 87 patients who developed dynamic ileus and aims: neurosurgical diagnosis (topography and severity of spine injury), symptoms, treatment, morbidity and mortality, secondary to neurosurgical lesions, but most important secondary to pulmonary and digestive complications. Information regarding patients and treatments were taken from case report forms and operative protocols.

Graphic no. 1. Patients with dynamic ileus of all patients with SCI



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RESULTS

Sex distribution revealed that the group of 87 patients consisted of 60 men (69%) and 27 women (31%).

Age groups distribution showed a significant risk for SCI within the 4th and 5th decades of life.

Graphic no. 2. Sex distribution

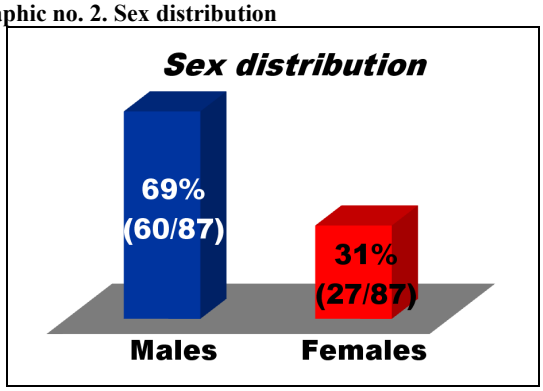
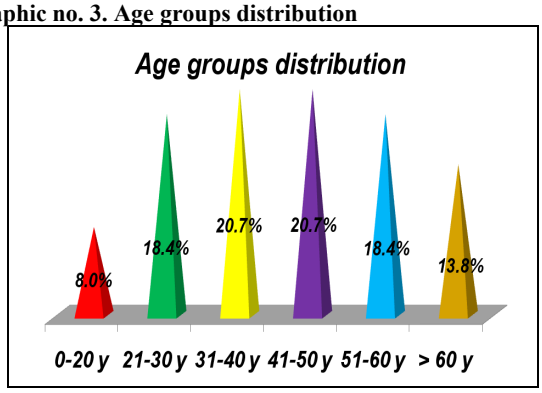


Table no. 1. Age groups distribution

No.	Age	No. cases	% cases
1	0-20 years	7	8%
2	21-30 years	16	18.4%
3	31-40 years	18	20.7%
4	41-50 years	18	20.7%
5	51-60 years	16	18.4%
6	> 60 years	12	13.8%

Graphic no. 3. Age groups distribution



Analysis of *etiology* showed that most SCI due to road accidents, followed by occupational accidents and assaults.

Table no. 2. Analysis of causes of SCI, in patients with dynamic ileus

No.	Causes of SCI	No. cases	% cases
1	Road traffic accidents	43	49.42%
2	Occupational accidents	17	19.15%
3	Assaults	16	18.39%
4	Sport accidents	8	9.19%
5	Others	3	3.44%

Within the study group, 60% of patients who developed dynamic ileus had cervical SCI, and 36% thoracic SCI. Only 4% had upper lumbar (L1) SCI.

Table no. 3. Topography of SCI, in patients with dynamic ileus

No.	Topography of SCI	No. cases	% cases
1	Cervical SCI	52	60%
2	Thoracic SCI	32	36%
3	Upper lumbar SCI (L1)	3	4%

Another key milestone in the outcome, frequency and types of complications, including dynamic ileus, of these patients, is the *severity* of SCI.(1,5,6) Grading of severity of SCI was made using sensory-motor impairment scale Frankel.

Graphic no. 4. Topography of SCI, in patients with dynamic ileus

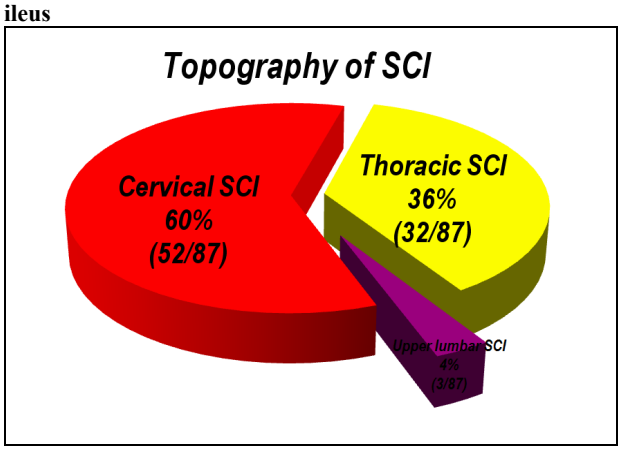
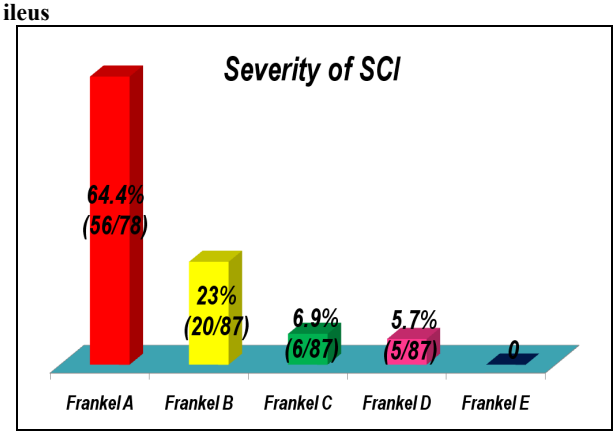


Table no. 4. Severity of SCI, in patients with dynamic ileus

No.	Severity of SCI	No. cases	% cases
1	Frankel A	56	64.4%
2	Frankel B	20	23%
3	Frankel C	6	6.9%
4	Frankel D	5	5.7%
5	Frankel E	0	-

Graphic no. 5. Severity of SCI, in patients with dynamic ileus



As mentioned before, the key of present series of 87 cases is dynamic ileus occurrence. From the total number of 111 patients with SCI, 87 cases developed dynamic ileus (78.3%), but considering preventive measures imposed from admission in severe SCI, perhaps that the natural outcome of these patients, in terms of digestive parameters, would have provided higher percentages of intestinal paresis. Given the sensory dysfunctions, sphincter impairment and severe general state of these patients, collecting certain information regarding abdominal condition was difficult and sometimes flawed.

Taking into consideration the fact that, in these patients, there is always some degree of intestinal paresis, without patent functional intestinal obstruction, we established the minimum period of time for *bowel transit loss* of 72 hours, for the patients to be included in our study group. The *period of time* elapsed since trauma till intestinal occlusion occurrence, taking into account the factors listed above, which probably have induced an error factor, was quite varied, depending on the severity of SCI, but also on other factors (age, co-morbidities, general biological status, etc.)

Table no. 5. Period of time since SCI, until dynamic ileus occurrence

No.	Period of time since SCI till dynamic ileus occurrence	No. cases	% cases
1	< 4 days	22	25%
2	4-7 days	49	56%
3	> 7 days	16	19%

The second element from the symptomatic triad, together with stool and gas transit loss is *abdominal pain*. In patients with SCI, where patients have sensory dysfunctions, it occurs late, is less powerful, having rather the character of abdominal discomfort, or feeling of "abdominal fullness".(5)

Table no. 6. Abdominal pain in the study group

No.	Abdominal pain	Character	No. cases
1	Absent	-	37
2	Present	Abdominal discomfort	45
3	Present	Colicative pain	5

Vomiting is the third element of the symptomatic triad. It is not present in all cases, because after bowel transit loss and abdominal distension, all patients underwent continuous digestive aspiration.(5)

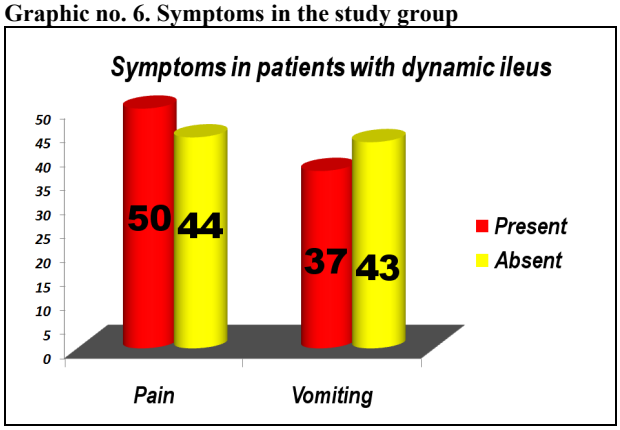
Table no. 7. Vomiting in the study group

No.	Vomiting	No. cases
1	Absent	43
2	Present	44

In our group, we had patients, which had had, besides dynamic ileus, associated abdominal pathology, with indication for surgery, which was decompensate within the traumatic event and led to diagnostic confusions and therapeutic errors.

In 12 cases, representing nearly 14%, independent abdominal co-morbidities or complications occurred within the new complex abdominal and digestive state of these patients. To these cases, with indication for surgery, 3 more cases were added, cases where there were no other abdominal pathology, but surgery was required secondary to persistent paresis digestive, irreducible to conservative treatment, carrying high risks for diastatic perforation.

Graphic no. 6. Symptoms in the study group



Patients diagnosed with associated abdominal pathology or patients where we had a high index of suspicion in this area, underwent surgery, except for two cases (1 case with acute cholecystitis and 1 case with acalculosis cholecystitis), in which conservative treatment has been satisfactory, and surgery could be postponed. These situations are exceptional cases, because usually any intra-abdominal septic focus or with any other location may be a cause for prolonging the digestive paresis and may carry a high risk for spinal cord surgery, or even vital risk.(5,6) Presence of intraperitoneal pathology, confirmed by the existence of potential surgical lesion, is a confusing element regarding diagnosis and treatment, whereas quantification of its contribution to dynamic ileus occurrence, following SCI is difficult.(5) There are no precise criteria regarding optimal operative timing or optimal expectative timing for a patient with ileus dynamic, therapeutic approach must be adapted to each case.(5,7)

Table no.8. Associated abdominal pathology, and its consequences

No.	Associated abdominal pathology	No. cases
1	Acute lithiasis cholecystitis	4
2	Acute acalculosis cholecystitis	2
3	Piosalpinx	1
4	Left colon tumor	2
5	Small bowel volvulus	2
6	Distal cecum perforation	1

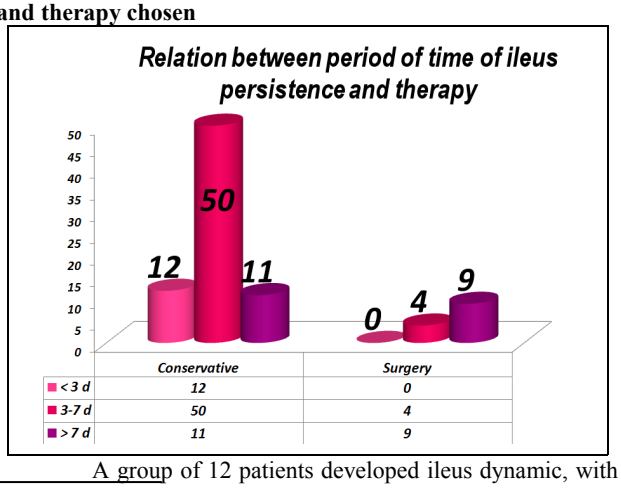
Table no. 9. Patients with dynamic ileus and associated abdominal pathology or complications of intestinal ileus, requiring surgery and operation type

No.	Associated abdominal pathology	No. cases	Operation
1	Acute lithiasis cholecystitis	3	Colecistectomy drainage
2	Acute acalculosis cholecystitis	1	Colecistectomy drainage
3	Piosalpinx	1	Salpingectomy draiange
4	Left colon tumor	2	Harthmann operation
5	Small bowel volvulus	2	Devolvulation, cecostomy
6	Distal cecum perforation	1	Cecostomy drainage
7	Irreducible dynamic ileus	3	Cecostomy drainage

Table no. 10. The medium time of dynamic ileus evolution and therapy chosen

No.	Days of ileus persistence	No. cases	Therapy
1	< 3 days	12	Conservative
2	3-7 days	54	Conservative 50 cases Surgery 4 cases
3	> 7 days	21	Conservative 11 cases Surgery 9 cases

Graphic no. 6. The medium time of dynamic ileus evolution and therapy chosen



A group of 12 patients developed ileus dynamic, with

low or medium severity, with relatively fast response to therapy (discontinuation of oral feeding, continuous digestive aspiration, correction of electrolyte and acid-base imbalances, correction of anemia, prokinetic factors administration, manual emptying and massage of the rectal ampula).(5,6) Patients from this group had no associated abdominal pathology and, therefore, surgery was not required in either case.

The second group of 54 patients, presented a dynamic ileus lasting from 3 to 7 days, and a total of 5 patients had associated abdominal pathology. There ware 4 operations including surgery for isolated dynamic ileus as well as for abdominal co-morbidities.

From the third group, composed of 21 patients, 9 patients underwent surgery, the remaining 11 patients finally responding to conservative treatment. Of the 9 operations, 7 were performed for mixed pathology.

The situation described above does not cover late surgery, for further correction or spinal cord surgery or two steps operations (cecostomy dissolution, etc.).

Table no. 11. Overall mortality in study group

No.	No. deaths	Cause of death
1	2	Abdominal complications
2	5	Neurosurgical complications
3	3	Others

There were 10 deaths (11.5%), suggestive for severity of the neurosurgical lesion, severity of abdominal pathology association, but also other severe complications that can lead to a lethal end.(5,6)

[redacted]

There is a clear predominance of such lesions in male patients. The explanation of this issue, is that men are more exposed to traumatic risks in different circumstances (high risk work, traffic accidents, assaults, sports accidents, etc.).(6,8,9) *Age groups* analysis showed that there was high risk within the life decades with intense activity (in adolescents predominantly sports injuries, in active people predominantly occupational accidents, road traffic accidents and assaults, and in elderly predominantly domestic accidents).(6,10,11) Causes of SCI are diverse, largely overlapping with data from specialty literature. (8-11) A substantial change in the structure of these cases occurred comparing with the data 2-3 decades ago, when frequency of road traffic accidents and assaults was lower. (12,13)

Gastrointestinal dysfunctions occurrence and evolution depends on topography, severity and phase of SCI.(5)

Topography of SCI is a key element, depending on which sensory-motor dysfunctions occur, as well as outcome and therapy particularities, and specific complications. After overcoming the spinal shock phase (which can last hours-days), in cervical and thoracic SCI, the initial paralytic ileus may be replaced by intestinal spasticity, which can persist during the chronic phase.[1,3-5,14] Spasticity of the intestinal wall frequently becomes chronic, with external anal sphincter hypertonia, loss of voluntary control of sphincter and anorectal dyssynergia, all together contributing to the difficulties of evacuation of the lower digestive tract. Reflex activity is maintained, peristaltic movements being maintained, especially when the bowel is stimulated.[1,3-5,14] Thoracic SCI may be accompanied by hematomas, and ribs fractures, more or less complex, possibly even fail chest, which can ventilation disorders, paving the way septic pulmonary complications.(5) Furthermore, paraspinal hematoma can descend into the retroperitoneal space, constituting an additional cause of abdominal distension, worsening the dynamic ileus initiated generated by neurogenic mechanism.(5,6) SCI below L1 induce at the beginning an atonic bowel, which is maintained during the chronic phase. Plus, voluntary control of defecation loss, atonic external anal sphincter and defecation reflex loss occurs.(1,3-5,14)

Severity of SCI generates a directly proportion of cases with dynamic ileus, emphasizing on the neurogenic mechanism of intestinal paresis.(5,6) From SCI class Frankel A there were 2/3 of cases with dynamic ileus, while in class Frankel E this complication almost is unseen. This justifies the concern to early initiation of preventive measures regarding digestive paresis to prevent or reduce its severity.(5,6,15)

All SCI go through two stages of evolution. Duration and amplitude of each phase depends on several factors, among which the most important is severity of SCI. The *acute phase*, spinal shock, is characterized by motor and sensory loss, flaccid paralysis, deep tendon reflexes loss below the level of injury, bowel and bladder paresis and thermoregulation dysfunctions. (1,5,6) Depending on the level of spinal cord lesion, respiratory and cardiovascular dysfunctions, and stool retention secondary to neurogenic megacolon can also occur.(1,5) The *chronic phase* is characterized by motor deficit, spasticity, neurogenic bowel, genitourinary dysfunctions and autonomic dysreflexia. (1,5,6,14,16-18)

Regarding the period of time since SCI till bowel ileus occurrence, almost 50% of patients developed this complication within 4-7 days, and 25% in 4 days (patients with severe SCI or co-morbidities).

Besides stool and gas loss, the "key" element of the clinical diagnosis, abdominal pain, vomiting, and abdominal distension, have also contributed to the positive diagnosis. Abdominal pain, although part of diagnostic elements, is not specific. This is due to the dynamic nature of ileus (where the pain is replaced with abdominal discomfort) and due to sensory dysfunctions of these patients.(5,19) In our group ⅓ of patients did not have abdominal pain and about ½ presented only abdominal discomfort. Vomiting completes the symptoms, contributing to the positive diagnosis, but it has been found only in half of patients. But when occurs, it has an important significance, decisively contributing hydroelectrolytic imbalances.(5,6) Therefore, monitoring of losses through vomiting or controlled digestive tract emptying, are important elements guiding the rebalancing treatment of these patients. (5,6) Abdominal distension is always present, and it is a consequence of bowel distension and can become very alarming, carrying high risk of diastatic perforation. Also, energetic actions to decompress and facilitate the resumption of intestinal "pump" function of the bowel are major priorities.(5)

In these conditions, the role of clinical diagnostics features and monitoring of these patients (quantity of continuous digestive aspiration, evolution of abdominal distension, intestinal peristaltic movements reoccurring, regaining digestive tolerance, diuresis, etc.) significantly increases, orientated by dynamic biological parameters (monitoring of renal function, levels of Na^+, K^+, Cl^-, hematologyical parameters, etc.)(5,15)

Conventional radiology has a crucial role in bowel ilues.(5) In the particular situation of our patients, a series of factors which limits the performance of these investigations (especially if it is necessary to repeat it) occur, and the information provided must be customized and interpreted in the special context of these patients. It is impossible, most times, to maintain upright position (abdominal radiography being carried out in lateral decubitus), repeated mobilization of patient is limited to avoid worsening neurological deficits, plus difficulties in interpreting the results and impossibility of dynamic follow-up.(5,6)

We had a constant interest to diagnose any worsening

or complications related to addition of the mechano-inflammatory element and diagnosis of abdominal pathology with indications for surgery, complicated in the new biological context, all requiring prompt surgery.(6) In our group of patients we found acute cholecystitis and acalculosis cholecystitis, colon tumors, septic genital pathology, as well as complications following prolonged and marked intestinal distension (intestinal volvulus, diastatic perforations), patients who underwent surgery. These cases represented 14% (12 cases). To this group of patients, 3 cases were added, with no intraperitoneal inflammatory pathology or complications secondary to ileus, in which the surgery was required for persistent abdominal distension with imminent risk of diastatic perforation. Global intestinal distension required emergent cecostomy.

Patients, who did not require surgery, had a dynamic ileus with various outcomes. Thus, a small percentage of patients exceeded dynamic occlusion under 3 days (12 cases), approximately ⅔ in a range between 3 and 7 days and in 21 patients ileus persisted over 7 days.

Outcome of these patients, conservative therapy and optimal timing for surgery must take into account the evolution of neurological complications and its complications and timing for spinal surgery. Obviously these factors have complicated decision making, establishing a sequence of conservative and surgical therapy measures, concordant to treatment's priorities, imposed by close interdisciplinary cooperation.

Despite efforts, and complex medical and surgical therapy, the outcome of 10 cases (15%) was lethal, 2 of which were due to abdominal complications.

CONCLUSIONS

Severe SCI is a serious pathology, with neurological sequelae and multiple complications, including important abdominal consequences. Dynamic ileus is a serious complication, frequently encountered in patients with SCI. Positive diagnosis of dynamic ileus was mainly made on clinics. Imaging data may be partial or equivocal, due to inability to maintain upright position and limited dynamic follow up. Severity of SCI plays a crucial role in triggering intestinal paresis, Frankel classes A and B providing 87.4% of cases of dynamic ileus. The most common locations of spinal cord lesions generating dynamic ileus, in descending order are the cervical, thoracic and high lumbar SCI. The period of time from SCI till dynamic ileus occurrence is, most probably, 4-7 days. Presence of dynamic ileus does not exclude the existence of a pre-existing abdominal pathology, which can be reactivated in the new traumatic context. Pathological association SCI-dynamic ileus is a frequent and serious morbid association, which may progress to secondary complications and significant local or systemic vital risks and whose solution requires intensive medical and surgical treatment.

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