Original Article

Outcome analysis of hip or knee arthroplasty in patients with cirrhotic liver disease

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ABSTRACT

Objective: Present helpful measures to prevent expected complications that occur in patients with liver cirrhosis undergoing arthroplasty.

Methods: 218 patients who underwent hip or knee arthroplasty were included in this study. Prognoses of patients with underlying disease of liver cirrhosis and those without are compared with measures.

Results: Patients with liver cirrhosis show an increase in amount of bleeding, hospital stay and infection rate compared to those who do not.

Conclusion: The risk of arthroplasty on patients with liver cirrhosis is higher than normal patients. Surgeons should carefully assess all cirrhotic patients pre- and postoperatively.

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1. Introduction

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) have proven to be effective surgical procedures.^{1,2} During the past decade, there has been a dramatic increase in the number of total joint arthroplasties in Korea.³ For patient care and economic reasons, there has been an increasing interest in identifying risk factors for complications and poor outcomes.^{4–6} Liver cirrhosis is the common last stage of all chronic liver diseases. Alcohol is by far the most common cause of cirrhosis in Korea.⁷ Cirrhosis of the liver, irreversible fibrosis of liver tissue leading to hepatic dysfunction, is a known risk factor for complications after THA and TKA.^{8,9} However, studies of patients with cirrhosis undergoing THAs and TKAs generally have numerous shortcomings, including lack of a control group, small sample sizes, contradictory results, and the use of the Child-Pugh classification as a measure of disease severity. The Child-Pugh system has limited clinical use for orthopaedic surgeons for preoperative risk assessment of THAs and TKAs because it involves a subjective assessment of ascites and encephalopathy, entities that are rarely assessed by many orthopaedic surgeons.^{10,11}

The purposes of our study were to determine the differences between patients undergoing elective or emergent THAs or TKAs

with cirrhosis compared with matched control subjects in our hospital.

We expected that the patients with cirrhosis would have much more complications than patients without cirrhosis. We aimed to evaluate another factor which can have an effect on complications.

2. Materials and methods

A retrospective analysis was performed in all cirrhotic patients who underwent primary THA or TKA at three hospitals between January 1, 2007 and December 31, 2015. Patients were classified according to the Child-Pugh score and type of surgery. Clinical, laboratory, and radiologic findings were used to diagnose liver cirrhosis. Cirrhotic patients were categorized according to the severity of liver cirrhosis using the Child-Pugh scoring system.¹² Non-cirrhotic patients who underwent THA or TKA at three hospitals between January 1, 2007 and December 31, 2015 were randomly selected as controls. The cirrhotic and control groups were checked in terms of laboratory findings related to the underlying disease, time of surgery, intra-operative bleeding, postoperative blood loss, length of hospital stay, medical and surgical complications, and mortality. Complications were divided into medical and surgical complications. Medical complications included significant cardiovascular events (myocardial infarction, congestive heart failure, or cardiac shock), deep venous thrombosis, renal failure, pulmonary embolus, systemic infection, and gastrointestinal problems (GI tract bleeding, Gastric ulcer).¹³ Surgical complications included hematoma formation around operation site, and superficial or deep infection.

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Table 1

The overall results of hip or knee arthroplasty patients with and without cirrhotic liver disease.

	Cirrhotic Patients (n = 110)	Control Group (n = 110)	P value
Age (y)	68.9 ± 10.9	72.4 ± 12.3	0.216
Sex (M:F)	66:44	73:37	0.320
Intraoperative bleeding (cc)	402.2 ± 339.2	363.0 ± 221.8	0.313
Postoperative blood loss (cc)	895.4 ± 849.1	695.4 ± 440.1	0.030
Operative time (minutes)	106.5 ± 46.0	113.5 ± 32.8	0.194
Hospital stay (days)	27.1 ± 24.0	16.1 ± 7.6	0.020
Platelet (/mm ³)	145.1 ± 63.0	253.2 ± 76.0	0.011
Medical complication (No.)	32	7	0.011
	Child-Pugh Scale		
Elective THA	A: 2 B: 1C: 0	1	
Elective TKA	A: 8 B: 4C: 0	2	
Urgent THA	A: 6 B: 6C: 5	4	
Surgical complication: infection(No.)	17	6	0.009
	Child-Pugh Scale		
Elective THA	A: 4 B: 0C: 1	2	
Elective TKA	A: 4 B: 1C: 0	1	
Urgent THA	A: 5 B: 1C: 1	3	

3. Statistical analysis

Comparisons were made using the Wilcoxon rank sum test or Kruskal-Wallis test. And each groups were compared using Student's *t*-test and a chi-square test for each continuous and categorical variables. Post-hoc comparisons were made using either Dunn's test or Bonferroni adjustment. Because of the sample size was too small to allow for multivariate analysis, only univariate analysis was performed.¹³ Results were deemed statistically significant when the *p* value was less than 0.05.

4. Results

Between 2007 and 2015, 110 cirrhotic patients underwent primary hip or knee joint arthroplasty surgery by four surgeons (TR Yoon, EK Song, JK Seon, and KS Park). The patients were divided into the following 3 groups: 1) elective THAs for joint disease (OA, AVN, *n* = 37), 2) elective TKAs for degenerative joint disease (OA, *n* = 34), and 3) urgent THAs for femoral neck or intertrochanteric fractures (*n* = 39). We excluded bipolar hemiarthroplasty which is treatment option for femoral neck or intertrochanteric fractures.

One hundred ten who age- and sex-matched control patients who underwent surgeries by the same surgeons were considered as controls in this study. The overall results of all THA or TKA surgeries are summerized in Table 1. Cirrhotic patients had much more estimated intraoperative bleeding and postoperative blood loss, longer total length of hospital stay, more major complications, and higher mortality rate compared with control groups.

Significant negative results (including medical and surgical complications and mortality) occurred at a rate of 53.6% (59 of 110) in the cirrhotic group compared with a rate of 11.8% (13 of 110) in the control group. Among cirrhotic patients, one death occurred in the elective THA group and two deaths occurred in the urgent THA group. In hospital mortality rate was 2.7%. All three patients were of Child – Pugh class C.

All elective THAs were performed for osteoarthritis and AVN in the cirrhotic and control groups. There were significantly different results between the elective THA group and the control group, except for the operative time in cirrhotic patients (Table 2). With respect to medical complications, 8.1% (3 of 37) of cirrhotic patients had medical complications whereas 2.7% (1 of 36) of controls had medical complications. Also, 13.5% (5 of 37) of cirrhotic patients deep infection around op site, whereas 5.6% (2 of 36) of controls all this joint-related complications required revision surgery. However, this difference of complications was not statistically significant (*P* = 0.84, *P* = 0.43) (Table 2).

All of the TKA were performed for only osteoarthritis in both groups. Again, there were significantly different results between the both groups, except for the operative time in cirrhotic patients (Table 3). Medical complications occurred in 35.2% (12 of 34) of cirrhotic patients, whereas medical complications occurred in 5.5% (2 of 36) of controls. Also, 17.6% (6 of 34) of cirrhotic patients had infection around TKA, whereas 2.8% (1 of 36) of controls and all this joint-related complications required revision surgery. In TKA groups, this difference in this complications was statistically significant (*P* = 0.03, *P* = 0.05).

Table 2

The results of elective Total Hip Arthroplasty (THA) between patients with cirrhotic liver disease and control group.

	Elective THA (n = 37)	Control group (n = 36)	P value
Age (y)	61.9 ± 11.8	62.9 ± 122.6	0.737
Sex (M:F)	30:7	26:10	0.220
Intraoperative bleeding (cc)	640.3 ± 401.6	394.4 ± 231.7	0.012
Postoperative blood loss (cc)	1093.1 ± 1245.1	727.4 ± 461.5	0.023
Operative time (min)	116.9 ± 47.2	105.0 ± 34.9	0.226
Hospital stay (d)	27.3 ± 27.9	11.1 ± 3.5	0.001
Medical complication (No.)	3	1	0.840
	Child-Pugh Scale		
	Child's A: 2		
	Child's B: 1		
	Child's C: 0		
Surgical complication (No.)	5	2	0.429
Infection	Child-Pugh Scale		
	Child's A: 4		
	Child's B: 0		
	Child's C: 1		

Table 3

The results of elective Total Knee Arthroplasty (TKA) between patients with cirrhotic liver disease and control group.

	Elective TKA (n = 34)	Control group (n = 36)	P value
Age (y)	72.2 ± 6.1	73.6 ± 8.0	0.437
Sex (M:F)	13:21	5:31	0.027
Intraoperative bleeding (cc)	169.4 ± 151.1	313.9 ± 168.4	0.002
Postoperative blood loss (cc)	1020.7 ± 422.1	843.8 ± 328.7	0.045
Operative time (min)	103.9 ± 36.1	115.4 ± 29.8	0.153
Hospital stay (d)	24.6 ± 13.4	18.4 ± 8.0	0.023
Medical complication (No.)	12	2	0.030
	Child-Pugh Scale		
	Child's A: 8		
	Child's B: 4		
	Child's C: 0		
Surgical complication (No.)	6	1	0.049
Infection	Child-Pugh Scale		
	Child's A: 5		
	Child's B: 1		
	Child's C: 0		

Table 4

The results of urgent Total Hip Arthroplasty (THA) between patients with cirrhotic liver disease and control group.

	Urgent THA (n = 39)	Control group (n = 38)	P value
Age (y)	75.5 ± 10.4	80.3 ± 9.1	0.061
Sex (M:F)	23:16	26:12	0.072
Intraoperative bleeding (cc)	619.5 ± 234.4	379.7 ± 252.3	0.026
Postoperative blood loss (cc)	907.1 ± 562.5	624.4 ± 463.0	0.034
Operative time (minutes)	99.0 ± 51.5	109.9 ± 32.6	0.058
Hospital stay (days)	29.1 ± 27.2	18.6 ± 8.0	0.024
Medical complication (No.)	17	4	0.011
	Child-Pugh Scale		
	Child's A: 6		
	Child's B: 6		
	Child's C: 5		
Surgical complication (No.)	6	3	0.212
Infection	Child-Pugh Scale		
	Child's A: 4		
	Child's B: 1		
	Child's C: 1		

All of the urgent hip arthroplasties were performed for acute femoral neck and intertrochanteric fractures. Significantly negative results were shown in almost category of cirrhotic patients (Table 4). Medical complications occurred in 43.6% (17 of 39) of cirrhotic patients, whereas medical complications occurred in 10.5% (4 of 38) of controls. This difference in the rate of medical complications was statistically significant ($P=0.01$). With respect to surgical complications, 15.3% (6 of 39) of cirrhotic patients had deep infection around op site, whereas 7.8% (3 of 38) of controls and all patients performed revision surgery. Only in urgent THA group, 2 patients had hematoma formation around THA and these patients recovered only conservative treatment.

Especially, there were no significantly correlation between Child–Pugh scale score and surgical complications ($P=0.66$). With respect to the additional laboratory findings related to the underlying disease, blood pressure, platelet, BUN/Cr ratio, and blood sugar level showed no significant correlation with surgical and medical complications. But almost all patients who had surgical complications had underlying diseases such as diabetes mellitus (DM), hypertension (HTN), and chronic kidney disease (CKD) (Table 5).

5. Discussion

Cirrhotic patients who undergo operation are at much more risk for complications and mortality than non-cirrhotic patients. A

previous study from the Mayo clinic reported that the safety of 733 general surgeries in cirrhotic patients in 1999.¹⁴ A 30-day perioperative complication rate of 30.1% and a mortality rate of 11.6% were reported; increased mortality in higher Child–Pugh grade. Another previous report evaluating GI surgery in cirrhotic patients showed 10%, 31%, and 76% mortality for Child's A, B, and C patients, respectively.¹⁵ The results of the other recent study showed 10%, 30%, and 82% mortality in Child's A, B, and C cirrhotic patients in GI surgery, respectively.¹⁶ The Mayo Clinic study included 26 patients undergoing combined hip and pelvic surgeries for fractures and the result of perioperative complication rate was reported as 53.8%.¹⁴ The only previously study that exclusively evaluated the safety of hip arthroplasty is a recent uncontrolled study from Taiwan that overall perioperative complication rate was 26.7%.¹⁷

The previously published data on the outcome of TKA in cirrhotic patients were included 41 Child's A cirrhotic patients and only 1 Child's B patient from a recent study in Taiwan.¹¹ They reported an overall perioperative complication rate was 43.1%. Compared with controls, the cirrhotic patients had significantly more operative blood loss, longer operative time and duration of hospitalization, and higher complication rate and mortality. Among all of previous studies, the most predictable and possible effecting factor of outcome was the preoperative Child–Pugh class.

On the other hand Cohen et al. reported a controlled retrospective study on the safety and outcome of THA and TKA

Table 5

Underlying disease for surgical complication of hip or knee arthroplasty patients with cirrhotic liver disease.

	Patients with complication	Patients without complication	P value
Child-Pugh Scale			
Child's A	13	–	
Child's B	2	–	
Child's C	2	–	
Mean platelet (/mm ³)	130354	148056	0.265
Diabetes mellitus	11	3	
Mean blood sugar level (mg/dl)	186	193	0.425
Hypertension	10	4	
Blood pressure (mm/Hg)	123	119	0.345
Mean systolic	84	85	0.521
Mean diastolic			
Chronic kidney disease	8	2	
Mean BUN/Cr ratio	1.02	0.89	0.776

in cirrhotic patients.¹³ In that study perioperative complications, liver decompensation, and mortality were not significantly different in matched control patients with Child's A and B cirrhosis. But In the most recent study Poultides et al. reported that patients undergoing THA or TKA identified comorbid liver disease as the strongest predictor of deep prosthetic infection and Hsieh et al. reported that prosthetic hip infections in cirrhosis patients are difficult to eradicate.¹⁸ Suggested mechanisms for this susceptibility is migration of bacteria from intestines, functional disorder of polymorphonuclear leukocyte, complement deficiency, and interruption of the reticuloendothelial system.¹⁹ 2 studies have reported exorvitant activation of IL-6 and TNF- in cirrhotic patients after surgery, and a subsequent acute-phase response.^{20,21}

We also evaluate a retrospective study on the outcome of elective THA, TKA and urgent THA in liver cirrhosis patients. On comparison with patients undergoing elective THA, TKA and urgent THA, it was observed that liver cirrhosis Child classification grade caused no significant difference in surgical complications on the contrary of previous studies. However in cirrhotic patients undergoing urgent THA, there were the differences in major complications and mortality rates compared with other groups. These patients undergoing urgent THA demonstrated a significantly increased need for blood transfusions, had greater intraoperative blood loss, longer overall hospital stay, and more major complications. In fact, almost 60% of the cirrhotic patients undergoing urgent THA had medical and surgical complications. Especially in patients of surgical complications, the analysis of the data revealed that the laboratory findings such as blood sugar level, blood pressure, Bun/Cr ratio, hematologic condition related to underlying disease showed no significant correlation with adverse outcomes, but patients with other combined disease such as DM, HTN, and CKD showed a higher incidence of postoperative surgical complications. All this patients were controlled well before and after surgery about underline disease. So, it seems necessary to further evaluate the probability of underlying disease-related poor outcomes in arthroplasty for cirrhotic patients.

For urgent THA, it is difficult to qualify the preoperative medical management. Mortality rate was also significantly increased in all cirrhotic THA patients undergoing elective (1 patient) and urgent (2 patients) operations, compared with elective operation. Therefore, after combining all of the patients undergoing THA (both elective and urgent) in our data, it was observed that the outcome depends on the quality of preoperative and postoperative management, especially for patients with combined common underlying disease such as DM, HTN, CKD and urgent operation. Close observation and cooperative work up with internal medicine specialty is a definite choice for perioperative care.

6. Conclusion

In conclusion, cirrhosis patients undergoing total hip or knee arthroplasty have an increased risk of perioperative and postoperative complications, including medical and surgical problems. Our results indicate that the risk applies to all cirrhosis patients and especially those with a combined disease such as DM, HTN, renal problem and urgent surgery. Hence, orthopedic surgeons should carefully assess all cirrhotic patients pre- and postoperatively, and especially those who have a medical problem particularly conditions such as DM, HTN, CKD and urgent operation.

Conflicts of interest

None.

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