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ORIGINAL RESEARCH PAPER

Hungry Bone Syndrome in Patients with End-Stage Renal Disease Receiving Hemodialysis

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Abstract

Objective: *Hyperparathyroidism develops in the majority of patients with end-stage renal disease receiving hemodialysis. Parathyroidectomy can be performed in cases who cannot be managed with medical therapy and a portion of the patients develop hungry bone syndrome (HBS) in the postoperative period. In this study, we investigated the factors that influence the development of HBS and the hospitalization times in hemodialysis patients who underwent parathyroidectomy.*

Method: *This study included 49 patients. Demographic, clinical and laboratory parameters of these patients were retrospectively evaluated.*

Results: *Patients' median age was 46 years (22-62). The parathyroid gland that showed hyperplasia the most frequently was the left inferior 79.6% (n=39), followed by the right inferior 77.6% (n=38) gland. Rate of four-gland hyperplasia was 32.7% (n=16). Of the 49 operated patients, 34 (69.4%) developed HBS. In patients with postoperative PTH <500 pg/ml, calcium < 7mg/dl during the first 24 hours after surgery and calcium infusion > 4 ampules during the first 24 hours, hospitalization times were prolonged and the need for parenteral calcium infusion was elevated.*

Conclusion: *The need for parenteral calcium replacement during the first 24 hours, postoperative PTH and calcium levels during the first 24 hours were determined to be factors indicating the severity of HBS in the postoperative period.*

Keywords: *Hungry bone syndrome, Hemodialysis, Chronic renal failure, Hyperparathyroidism, Calcium*

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Introduction

Calcium and phosphate homeostasis is regulated by the parathyroid hormone (PTH) and calcitriol. PTH is secreted via the activation of the calcium-sensing receptors on the parathyroid gland due to hypocalcemia [1]. Generally, parathormone receptors are found in the bone tissue and kidneys [2]. Secondary hyperparathyroidism involves the biochemical abnormalities of the mineral disorders of the bone and occurs in the majority of patients with end-stage renal disease receiving hemodialysis [3]. Chronic hyperphosphatemia, hypocalcemia, 1,25-dihydroxyvitamin D are the primary factors that stimulate PTH synthesis and parathyroid cell proliferation [4]. In cases that cannot be managed with diet, phosphate binders and calcitriol therapy, an indication for parathyroidectomy arises [5]. Hungry bone syndrome (HBS) was first described by Albright and Reifenstein in 1950 when long-term hypocalcemia and hypophosphatemia occurred in a patient with hyperparathyroidism following parathyroidectomy [6]. HBS develops in patients who undergo parathyroidectomy due to primary, secondary or tertiary hyperparathyroidism [7]. It is believed that the sudden decline in the serum PTH concentration after parathyroidectomy alters the balance between bone formation and absorption, supports bone formation through a substantial increase in the skeletal calcium uptake, which results in severe hypocalcemia. Although this is a transient phenomenon that resolves with calcium and active vitamin D supplementation, patients with HBS may develop severe hypocalcemia with life-threatening complications, i.e. cardiac arrhythmia, tetany and laryngeal stridor. Previous studies have reported the incidence of HBS to vary between 28% and 88% in patients with end-stage renal disease receiving hemodialysis who underwent parathyroidectomy due to the diagnostic criteria of HBS [8]. A large parathyroid adenoma size, age>60 years, high pre-parathyroidectomy PTH, alkaline phosphatase (ALP) and calcium levels constitute risk factors for HBS [7]. In patients with HBS, which is characterized by rapid, deep and long-term hypocalcemia, the total serum calcium concentration is usually below 8.4 mg/dl and hypocalcemia for more than four days postoperatively is encountered [9]. Hospitalization times are generally associated with the severity of hypocalcemia [10]. Very few studies have been conducted on HBS in patients with end-stage renal disease receiving hemodialysis. Determining the risk factors for HBS preoperatively is very important for early diagnosis, treatment and hospitalization times. The present study aims to determine the incidence of HBS in patients with end-stage renal disease receiving hemodialysis, to investigate the risk factors and the factors that influence the hospitalization times.

Materials and Methods

This study included 49 patients with end-stage renal disease receiving hemodialysis who underwent parathyroidectomy due to tertiary hyperparathyroidism, which is a complication of this disease, and were followed up in the nephrology clinic for HBS in Yuzuncu Yil University, Medical Faculty Hospital between 2006-2020. Clinical and laboratory findings of the patients were retrospectively reviewed through the hospital automation system and archived files. Materials to be sent to the hospital laboratory are received and sent according to standard protocols. Clinical (age, gender, time with chronic renal failure (CRF), time on dialysis, parathyroid gland(s) with hyperplasia and their number, treatments received, hospitalization time) and laboratory **[**ALP, calcium, phosphate, PTH **(**PTH blood sample was taken between 08:00 and 10:00 a.m., measured preoperative and within 24 hours postoperatively, regardless of calcium level**)**, platelet count**]** findings were evaluated with respect to their relationship with the patients' hospitalization times and the treatments they received. Patients on peritoneal dialysis, patients diagnosed with CRF not receiving dialysis, patients with nephrotic or nephritic syndrome, patients who received a kidney transplant and patients with inadequate data were not included in the study. Our study was approved by the Yuzuncu Yil University Medical Faculty Ethics Committee (date/reference number: 11.12. 2020/2020/10-11).

Statistical Analysis: SPSS 18.0 program package was used in the statistical analysis of the data. Descriptive statistics were used to evaluate patient characteristics and the frequency of parameters, the Mann-Whitney U test was used for the analysis of non-normally distributed or non-parametric variables. T-test, chi-square test, Fisher's exact and Mann-Whitney U tests were used for univariate analysis. A confidence interval of 95% and a p-significance level <0.05 were adopted. For the analysis of hospitalization times and influencing factors, the Kaplan-Meier method (log-rank) and Cox regression analysis were used.

Result

Our study included a total of 49 end-stage renal disease patients receiving hemodialysis who underwent parathyroidectomy for tertiary hyperparathyroidism, comprising 23 (46.9%) females and 26 (53.1%) males. The patients' median age was 46 years (22-62), median time with CRF was 10 (3-13) years and median time on dialysis was 8 (1-13) years. The most common CRF etiology was found to be hypertension 27% (n=13). The parathyroid gland that showed hyperplasia the most frequently was the left inferior 79.6% (n=39), followed by the right inferior 77.6% (n=38) gland.

The rate of four-gland hyperplasia was 32.7% (n=16). Of the 49 operated patients, 34 (69.4%) developed HBS. The patients' mean time of hospitalization for parenteral treatment was 8.6 days (1-42), mean total parenteral calcium requirement during the first seven days of hospitalization was 54.7 (95% CI; 46-63.4) ampules (each ampule containing 225 mg calcium gluconate monohydrate + 572 mg calcium levulinate dihydrate). Intravenous calcium replacement was performed in symptomatic patients, and the target calcium level was accepted as at least 7.5 mg/dL. Other findings are summarized in Table 1. Mean laboratory results obtained preoperatively and on the first postoperative day (Table 2) are, respectively: PTH (pg/ml): 2038 (95% CI; 1927-2310), 416 (95% CI; 254-602), ($p<0.001$), calcium (mg/dl): 9.9 (95% CI; 9.5-10.1), 7.9 (95% CI; 7.3-8.2), ($p<0.001$), phosphate (mg/dl): 5.3 (95% CI; 4.5-5.9), 4.3 (95% CI; 3.9-4.7), ($p<0.001$), platelet (x 103/microL): 214 (95% CI; 190-239), 194 (95% CI; 176-215), ($p=0.012$). When compared with regard to HBS occurrence, there was a significant relationship between HBS and postoperative PTH levels ($p=0.04$). Other laboratory (pre- and postoperative ALP and platelet count) and clinical (time on dialysis, time with CRF, gender, age) parameters did not show a significant relationship with HBS. While 34 (69.4%) patients showed need for parenteral calcium replacement on postoperative day 1, the need for parenteral calcium replacement persisted in only 3 (6.1%) patients on the 21st day (Figure 1, Table 3). When the factors influencing the hospitalization time were evaluated; postoperative PTH <500 pg/ml, calcium level< 7mg/dl during the first 24 hours after surgery and calcium infusion > 4 ampules during the first 24 hours were associated with prolonged hospitalization times and an elevated need for parenteral calcium infusion (Table 4). Again, when considered in terms of the duration of hospitalization requiring parenteral calcium infusion; gender, time with CRF, time on dialysis, number of hyperplastic glands, preoperative laboratory results (calcium, phosphate, PTH, ALP, platelet count) and postoperative platelet count and phosphate levels were not found to be statistically significant. However, it was found in the univariate analysis that the calcium level during the first 24 hours and PTH levels on the first day postoperatively, as well as the parenteral calcium requirement on the first day, had borderline statistical significance in predicting the hospitalization time, and in multivariate analysis that the calcium level during the first 24 hours and PTH levels on the first day postoperatively were statistically significant predictors of hospitalization time (Table 5).

Table 1. *Basal characteristics of all patients*

	N=49 (%)
Age yr (median, range)	**46(22-62)**
Gender	
Male	**26(53.1)**
Female	**23(46.9)**
Etiyology	
HT	**13(27)**
DM	**3(6)**
Nephrolithiasis	**3(6)**
PCKD	**2(4)**
others	**28(57)**
Gland localization	
Superior	
Right	**24(49)**
Left	**26(46.9)**
İnferior	
Right	**38(77.6)**
Left	**39(79.6)**
Hyperplasic gland count	
1	**13(26.5)**
2	**10(20.4)**
3	**10(20.4)**
4	**16(32.7)**
Duration of dialysis yr (median, range)	**8(1-13)**
Duration of CRF yr (median, range)	**10(3-13)**

CRF: Chronic renal failure, **HT:** Hypertension, **DM:** Diabetes mellitus, **PCKD:** polycystic kidney disease

Table 2. *Comparison of preoperative and postoperative first day laboratory values*

	Level (mean, std dev.)	**P value**
Calcium mg/dl		**<0.001**
Preoperative	9.9(0.9)	
Postoperative	7.9(1.4)	
Phosphorus mg/dl		**<0.001**
Preoperative	5.3(1.6)	
Postoperative	4.3(1.3)	
parathyroid hormone pg/ml		**<0.001**
Preoperative	2038(707)	
Postoperative	416(503)	
Platelet x 10^3/microL		**0.012**
Preoperative	214(79)	
Postoperative	194(62)	

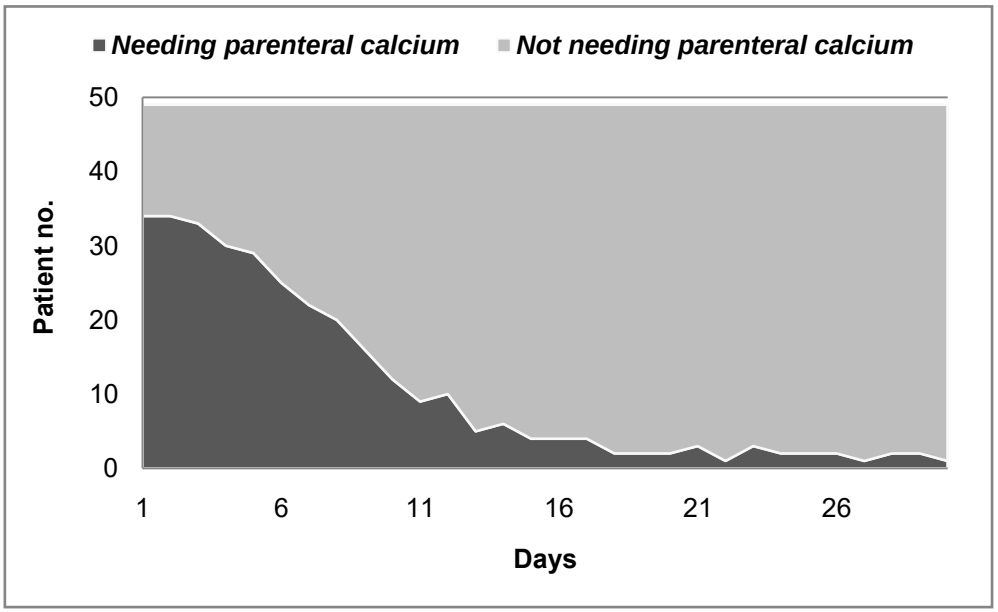

Figure 1: The proportion of patients requiring intravenous calcium replacement by day in patients with hungry bone syndrome

Table 3. Postoperative calcium phosphorus levels and the need per patient daily parenteral calcium replacement with hungry bone syndrome

	Patient requiring calcium replacement (n)	Ca mg/dl	P mg/dl	Ca x P	Daily mean calcium replacement per patient (ampoule*)
1st day	34	7.9(5.7-12.7)	4.2(2.2-6.2)	29(15-80)	6(2-12)
2nd day	34	7.2(4.8-9.9)	3.2(2.3-7.0)	23(11-61)	8(6-14)
3rd day	33	7.4(4.9-10.1)	3.6(2.2-7.5)	27(12-70)	8(4-12)
4th day	30	7.7(4.6-9.5)	3.1(1.9-7.9)	23(11-75)	7(4-12)
5th day	29	7.8(4.6-9.4)	3.0(1.7-6.4)	24(10-37)	6(2-12)
14th day	6	8.0(6.3-9.0)	5.0(3.4-5.4)	45(22-51)	5(3-8)
21st day	3	9.4(8.4-10.7)	3.0(2.5-4.1)	21(28-44)	5(2-8)

Ca: Calcium, **P:** Phosphorus,
*Each ampoule contained 225 mg calcium gluconate monohydrate + 572 mg calcium levulinate dihydrate.

Table 4. *Factors affecting the length of stay in the hospital*

	Length of stay in the hospital (day) (mean, 95% CI)	**Log-rank P**
All patients	8.6(6.1-11.0)	
Postoperative PTH (pg/ml)		**0.030**
≥ 500	4.9(2.4-7.3)	
< 5 00	10.6(7.3-13.9)	
Calcium level in the first 24 hours (mg/dl)		**0.036**
≥ 7	6.8(4.6-9.0)	
< 7	12.3(6.7-17.8)	
Calcium requirement for the first 24 hours (ampoule*)		**0.038**
≤ 4 ampoule	5.6(2.9-8.2)	
> 4 ampoule	11(7.4-14.7)	

PTH: parathyroid hormone,
*Each ampoule contained 225 mg calcium gluconate monohydrate + 572 mg calcium levulinate dihydrate.

Table 5. *Effects of parameters on length of stay in hospital requiring parenteral calcium replacement*

	Univariate analysis		**Multivariate analysis**	
	HR (95% CI)	**P value**	**HR (95% CI)**	**P value**
Gender	0.76(0.43-1.36)	0.36		
Duration of CRF	0.98(0.87-1.11)	0.84		
Duration of dialysis	1.12(0.93-1.34)	0.21		
Hyperplasic gland count	0.91(0.71-1.16)	0.45		
Preoperative				
Calcium	0.99(0.73-1.33)	0.95		
Phosphorus	1.04(0.85-1.28)	0.64		
parathyroid hormone	1(0.99-1.0)	0.27		
Platelet	1(0.99-1.0)	0.59		
Alkaline Phosphatase	1(0.99-1.0)	0.33		
Postoperatif				
Calcium	0.53(0.28-0.9)	**0.05**	0.39(0.18-0.84)	**0.016**
Phosphorus	1.16(0.92-1.46)	0.19		
parathyroid hormone	0.52(0.27-0.9)	**0.05**	0.32(0.15-0.68)	**0.003**
Platelet	0.9(0.9-1.0)	0.49		
Day 1 IV. calcium replacement	0.56(0.31-1.0)	**0.05**	0.66(0.35-1.23)	0.19

CRF: Chronic renal failure, **IV:** intravenous

Discussion

HBS is encountered frequently in parathyroidectomies performed due to secondary hyperparathyroidism, which is a complication associated with end-stage renal disease [5,6]. This study included 49 patients receiving hemodialysis who were followed up in our clinic due to end-stage renal failure and developed tertiary hyperparathyroidism. These cases had undergone parathyroidectomy due to non-response to medical treatment. They had been followed up in our clinic due to the risk of hypocalcemia. Of the cases, 34 (69.4%) were found to have developed HBS that would require parenteral calcium infusion. Although there exists no exact definition for HBS in the literature, it was described in a study that included 198 cases as a serum calcium level below 8.5 mg/dl and a phosphate level below 3.0 mg/dl during the first three postoperative days [10]. In another study, 148 end-stage renal disease patients were evaluated and the rate of HBS in CRF was reported as 20% [11]. In our study, the rate of HBS was 69.4% among CRF hemodialysis patients, which was higher compared with the rates reported in the literature. We reasoned that this situation could be linked to the fact that our clinic admitted patients who were at higher risk for HBS. In HBS, hypocalcemia can present with benign conditions such as fatigue, headache, paresthesia, while it can sometimes become manifest with the symptoms of arrhythmia, laryngeal stridor, tetany, convulsion and heart failure [12]. In one patient, a scapula fracture occurred due to convulsions during hemodialysis. Postoperative HBS is encountered more frequently in individuals with certain risk factors. Advanced age, large parathyroid gland size, high ALP levels, high blood urea nitrogen, presence of advanced bone disease can be listed among the clinical and laboratory risk factors for HBS. Meanwhile, hospitalization times of the patients are reported to be linked to the severity of hypocalcemia [10]. Conditions such as advanced age, reduced renal 1α-hydroxylase activity, low-calcium diet, which are risk factors for HBS [10], are associated with a negative calcium balance and bone disease [13]. In our study, age, gender, time on dialysis and time with CRF were not associated with the patients' postoperative hospitalization times and parenteral calcium replacement needs. In a study by Jofre and colleagues, multinodular hyperplasia was found in 79.5% of the glands and nodular hyperplasia was found in the remaining 20.5% [11]. Hyperplasia of multiple glands is encountered more commonly in CRF-related tertiary hyperparathyroidism [14]. In our study, hyperplasia was encountered the most frequently in the left inferior parathyroid gland 79.6% (n=39), and the least frequently in the left superior parathyroid gland 46.9%. Thirty-six (73.5%) patients had modular hyperplasia, 13 (26.5%) patients had nodular hyperplasia and 16 (32.7%) had

four-gland hyperplasia. However, the number of hyperplastic parathyroid glands was not correlated with the duration of postoperative hypocalcemia. Preoperative serum ALP levels reflect the bone turnover, osteoclast activity and the degree of osteoporosis. Preoperative ALP levels may provide information as to the severity and duration of hypocalcemia, which can develop after a successful parathyroidectomy [15]. In our study, preoperative ALP, calcium, phosphate, PTH and platelet levels were not found to be associated with the hospitalization time (Table 5). Although the hypocalcemia duration is variable, it can approach 3 months in some patients [16]. In our study, the mean duration of hypocalcemia that required hospitalization was 8.6 (1-42) days. However, postoperative calcium level< 7mg/dl during the first 24 hours, PTH <500 pg/ml during the first 24 hours and calcium infusion > 4 ampules during the first 24 hours predicted a long hospitalization time requiring parenteral calcium replacement (Table 4). As expected, the comparison of the preoperative and postoperative values in our study showed a statistically significant decline in PTH, calcium, phosphate levels. Furthermore, a significant decrease was also determined in the postoperative platelet count when compared with the preoperative levels (p=0.012). There is no data in the literature that clearly reveals the relationship between hypocalcemia, hypoparathyroidism and thrombocytopenia. We reasoned that this situation could be linked to the decrease in the levels of calcium, which is a coagulation factor.

The limitations of our study included the small number of patients and the single-center study.

Conclusion:

Since bone turnover and calcium phosphate homeostasis are multifactorial conditions, they are difficult to explain by a single parameter. The severity and duration of hypocalcemia varies across patients. According to the results of our study, the need for parenteral calcium replacement during the first 24 hours, postoperative PTH and calcium levels during the first 24 hours can be listed as factors indicating the severity of HBS in the postoperative period. However, it should be remembered that postoperative hypocalcemia is a serious condition that can even result in bone fractures.

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ORIGINAL RESEARCH PAPER

Comparison of Leg, Back and Claw Strength Values of Elite Taekwondo, Athletes and Hawkey Players

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Abstract

Objective: *The purpose of this research was to compare the leg, back, and claw strength values of elite taekwondo players, athletes, and field hawkey players.*

Method: *While the universe of the research consists of elite taekwondo players, athletes, and field hawkey players in Turkey, the sample consists of 94 elite athletes, including 16 male and 16 female elite taekwondo players, 16 male and 14 female field hawkey players, and 12 male and 20 female athletes. While the athletes' leg and back strength were measured using a Leg-Back Dynamometer, claw strength was measured using a Hand Dynamometer.*

Results: *According to the data obtained, a significant difference was determined in the leg strength, back strength and claw strength values of the elite female athletes participating in the research according to their branches ($p<0.05$). In these determined differences; It was determined that taekwondo players have higher values.*

Conclusion: *Consequently; leg, back and claw strength values of female elite taekwondo players from elite female athletes and field hawkey players; It can be said that the leg and back strength values of elite male athletes and field hawkey players may be higher than elite male taekwondo players.*

Keywords: *Strength, Athletics, Taekwondo, Hawkey.*

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Introduction

One of the parameters that affect performance in sports is physical characteristics or body composition. Body composition is one of the important indicators for an athlete in terms of the efficiency of his physical and physiological capacity. The physical structure characteristic of the athlete is important for achieving the expected level of performance of his fitness for the sport he has done. However, physical structure is not enough for an athlete to determine performance alone, but combined with other performance indicators such as strength, strength, flexibility, speed, endurance and quickness, it positively affects the athlete's performance [1,2].

Whenever we take a look from past and current to studies in the field of sport science athletes leg strength, jumping, flexibility and anaerobic power measured in these studies were evaluated separately or together important performance parameters, such as parameters and that are mentioned they were impressed with each other and also examined the effects on the degree of the physical elements [3].

It is well acknowledged that the relevance of five fundamental biomotor abilities, namely strength, speed, endurance, coordination, and flexibility, is quite high across a variety of sports (athletics, taekwondo, basketball, volleyball, swimming, handball, baseball, football, hawkey, field hawkey, etc.)[4]. Remarkably, there is limited evidence to compare these biomotor talents with other athletic populations. For a variety of reasons, trainers and coaches are hesitant to discuss the outcomes of their work with their colleagues and peers [5, 6].

As a result, it is difficult to assess trainers, trainers, and athletes who analyze athletes' athletic performance. Furthermore, creating scientific evaluations of athletes may differ between sports branches[7]. In order to overcome the problems in the sequence of events that occurred, some trainers, using the normative data obtained from the tests used before them; they change the training they do in their own sportive branches and make them more original[8].

If facilities allow, normative data are provided for various athletes. Descriptive data are presented within the sporting data for which normative data are not available[9].

As can be understood that; this data is of particular importance for; athletes, trainers, and researchers in the relevant field. Based on all this information; Purpose this study was to compare the leg strength, back strength and claw strength values of elite taekwondo players, athletes and field hawkey players and to examine the differences between branches.

Materials and Methods

This study compared the leg strength, back strength, and claw strength values of top taekwondo players, athletes, and field hawkey players using the causal comparison research model, one of the quantitative research designs. Elite taekwondo players, athletes and field hawkey players in Turkey constitute the universe of the research; the sample is; Those who want to participate in the research voluntarily, between the ages of 18-36 (years), from all branches and genders; 10 male, 10 female elite taekwondo players, 10 male, 10 female field hawkey players and 10 male and 10 female; comprised of at least 60 elite athletes in total. The research was carried out in the gym of Dicle University/School of Physical Education and Sports and at the same time of each day (15.00-18.00) where measurements were realized.

The data was formed from the personal data collection form created by the researchers and the tests preferred for the measurement of physical and physiological performance within the scope of the research. In the scope of the research; apart from the descriptive variables of elite athletes; height, body weight, body mass index, leg strength, back strength and claw strength were measured. The height and body weight of all elite athletes who will participate in the research were determined with a digital scale with a SECA® 769 height gauge with a precision of 1 millimeter and 100 grams. Body weight measurements, on the other hand, were determined by dividing the athletes in standard sports clothes (shorts, T-shirts) with a minimum level of clothing and bare feet in accordance with the predetermined techniques was calculated as (kg/m2) [10,11].

Besides, the determination of leg strength measurements was carried out using Takei brand back and leg (back and lift) dynamometer[12].

The dynamometer used is based on the pressure principle with standard settings. According to the working protocol of the dynamometer; it is based on the principle that the pointer moves by stretching the existing steel wire when an external force is applied. Thanks to the indicator on the dynamometer used in line with this protocol, the force applied by the person is determined in kilograms (kg). Before taking the measurements, a five-minute warm-up protocol was applied to the participants to warm up [13,14,15].

Following a five-minute warm-up, participants were instructed to position their feet on the dynamometer table, knees bent. They raised the dynamometer bar that they gripped with their hands vertically using their legs at the maximum level after positioning their feet on the dynamometer table with their knees bent, arms stretched, knees bent between 130-140 degrees, backs straight, and bodies slightly bent forward. The subjects were given a complete rest time and instructed to perform

the test twice after the initial upward pull was a trial. The best value obtained after two trials for each participant was recorded in kg. [12,13,14,15].

The back strength measurements of the participants were performed using the back and lift dynamometer developed by Takei [16,17,18].

In accordance with the test protocol, the participants were asked to place their feet on the dynamometer bench with their knees bent, keep their arms stretched, lean their back straight and slightly forward the body, and then pull the dynamometer bar that they grasped with their hands vertically, using their back muscles as much as possible. The claw strength measurements of the participants were also measured using the Hand Grip brand (Hand dynamometer) developed by Takei. Following a five-minute warm-up period, measures were collected while standing, without bending the arm to be measured and without contacting their body, with the arm at a 45° angle to the body. Following the completion of the protocol for the right and left hands, this test was done twice with a full rest interval in between. The values gathered were recorded in kg as the best value for the right and left hands [12,13,14,15,16,17,18].

Statistical Analyses: SPSS 22.0 statistical package program was applied for statistical analysis of the data. After collecting the data, arithmetic mean (X), standard deviation (Sd.), and maximum (Max.) and minimum (Min.) values were determined for the parameters obtained. To test the normality of the received data, it was determined by the Shapiro-Wilk Normality Test. If parametric test assumptions were met, differences between groups were determined using one-way analysis of variance and post hoc LSD test (One-Way-ANOVA-post hoc LSD) in accordance with the design of the study. The LSD (least significant difference) method applies standard t-tests to all possible pairs of group means. The LSD test is a post-hoc statistic that is considered objectionable if the number of groups (k means) for which the difference will be determined is more than 3. Mathematically, it is highly vulnerable to type I error. Because although the type I error level (α) is chosen as 5%, the amount of error per group increases as the number of groups increases. Therefore, LSD multiple comparison statistics should not be used if the number of groups was being compared is large or more than 3. The statistical significance level in the study was accepted as $p<0.05$[19,20].

Result

The findings of this study in which the leg, back and claw strength values of elite taekwondo players, athletes and hawkey players were compared are given in Table 1, Table 2 and Table 3.

Table 1. Descriptive Data of Elite Athletes Participating in the Research

Branch	Gender	n	Parameter(Unit)	Minimum	Maximum	$\bar{X}$± Sd.
Taekwondo	Male	16	Age(years)	17,0	20,0	18,1±1,2
			Stature(m)	1,65	1,85	1,76±0,1
			Body Weight(kg)	51,0	71,0	60,5±6,4
			BMI(kg/m^2)	17,04	22,41	19,6±1,7
			Leg Strength(kg)	60,00	140,00	113,5±26,5
			Back Strength(kg)	95,00	120,0	108,8±9,9
			Claw Strength(kg)	35,0	50,0	41,9±5,0
	Female	16	Age(years)	17,0	22,0	19,0±1,4
			Stature(m)	165,0	180,0	1,73±0,1
			Body Weight(kg)	55,0	60,0	57,6±1,8
			BMI(kg/m^2)	18,17	20,57	19,4±1,0
			Leg Strength(kg)	65,00	110,0	89,7±19,2
			Back Strength(kg)	75,0	90,0	83,4±6,3
			Claw Strength(kg)	27,0	42,0	38,6±3,8
Hawkey	Male	16	Age(years)	17,0	19,0	17,9±0,1
			Stature(m)	160,0	183,0	1,75±0,1
			Body Weight(kg)	50,0	80,0	65,4±10,6
			BMI(kg/m^2)	17,93	24,97	21,3±2,4
			Leg Strength(kg)	68,0	173,0	133,8±32,6
			Back Strength(kg)	71,0	138,0	117,8±21,6
			Claw Strength(kg)	27,0	57,0	43,8±9,1
	Female	14	Age(years)	17,0	19,0	17,9±1,0
			Stature(m)	146,0	165,0	1,60±0,1
			Body Weight(kg)	45,0	55,0	49,2±4,0
			BMI(kg/m^2)	17,47	22,89	19,4±2,0
			Leg Strength(kg)	73,0	80,0	76,0±2,7
			Back Strength(kg)	62,0	75,0	70,4±4,8
			Claw Strength(kg)	24,0	32,0	27,6±9,1
Athleticism	Male	12	Age(years)	17,0	20,0	17,7±1,2
			Stature(m)	172,0	180,0	1,8±0,1
			Body Weight(kg)	54,0	67,0	58,5±4,3
			BMI(kg/m^2)	17,99	20,68	18,9±1,0
			Leg Strength(kg)	115,0	170,0	141,3±18,1
			Back Strength(kg)	110,0	140,0	126,2±9,9
			Claw Strength(kg)	34,0	43,0	39,0±3,1
	Female	20	Age(years)	17,0	19,0	17,4±0,7
			Stature(m)	162,0	173,0	1,7±0,01
			Body Weight(kg)	43,0	61,0	50,5±5,4
			BMI(kg/m^2)	15,99	20,62	18,1±1,6
			Leg Strength(kg)	42,0	120,0	78,6±21,9
			Back Strength(kg)	52,0	93,0	73,3±15,1
			Claw Strength(kg)	34,0	43,0	32,5-3,0

In Table 1; the age, height, body weight, body mass index (BMI), leg strength, back strength and claw strength values of the elite male and female athletes participating in the research are given in detail according to their branch and gender.

Table 2. Comparison of Leg, Back and Claw Strength Values of Elite Female Athletes Participating in the Study

Parameter	Branch/Branch No	n	X̄± Sd.	F	Sd.	p	Post Hoc
Leg Strength (kg)	Taekwondo/1	16	89,7±19,2	4,455	2	,041*	1>3(p= ,041)*
	Hawkey/2	16	76,0±2,7				
	Athleticism/3	12	78,6±21,9				
Back Strength (kg)	Taekwondo/1	16	83,4±6,3	6,623	2	,003*	1>2(p= ,001)* 1>3(p= ,006)*
	Hawkey/2	16	70,4±4,8				
	Athleticism/3	12	73,3±15,1				
Claw Strength (kg)	Taekwondo/1	16	38,6±3,8	8,694	2	,001*	1>2(p= ,001)* 1>3(p= ,006)*
	Hawkey/2	16	27,6±9,1				
	Athleticism/3	12	32,5±3,0				

***p<0.05**

In Table 2, there was a significant difference determined in the leg strength, back strength and claw strength values of the elite female athletes participating in the research according to their branches ($p<0.05$). In these determined differences; It was determined that taekwondo players had higher values than athletes in leg strength values, taekwondo players had higher values than both athletes and field hawkey players in back strength values, and taekwondo players had higher values than both athletes and field hawkey players in claw strength values ($p<0.05$).

Table 3. Comparison of Leg, Back and Claw Strength Values of Elite Male Athletes Participating in the Study

Parameter	Branch/Branch No	n	X̄± Sd.	F	Sd.	P	Post Hoc
Leg Strength (kg)	Taekwondo/1	16	113,5±26,5	4,143	2	,023*	3>1(p= ,010)* 2>1(p= ,040)*
	Hawkey/2	16	133,8±32,6				
	Athleticism/3	12	141,3±18,1				
Back Strength (kg)	Taekwondo/1	16	108,8±9,9	4,501	2	,017*	3>1(p= ,005)*
	Hawkey/2	16	117,8±21,6				
	Athleticism/3	12	126,2±9,9				
Claw Strength (kg)	Taekwondo/1	16	41,9±5,0	1,846	2	,171	n/a
	Hawkey/2	16	43,8±9,1				
	Athleticism/3	12	39,0±3,1				

***p<0.05**

In Table 3 there was a significant difference found in the leg strength and back strength and values of the elite male athletes participating in the research according to their branches ($p<0.05$). In these detected differences; It was found that athletes and field hawkey players had higher values than taekwondo players in leg strength values, and athletes had higher values than taekwondo players in back strength values ($p<0.05$). Yet, there was no significant difference found in the claw strength values of the elite male athletes participating in the study according to their branches ($p<0.05$).

Discussion

Ozkan et al. (2014) encapsulated a total of 59 participants, 28 female and 31 male. They found that there was a statistically significant relationship between the height and body weight measurements taken from the participants and their hand claw strength[21]. In a similar study by Şahin et al. (2011) it was stated that there was a significant relationship between body weight and hand claw strength [22]. When the findings of our study were examined, it was determined that the average of the claw strength increased with the average body weight in all of the athletes in the selected branches. At this point, it can be said that there is a positive relationship between the body weights of the athletes and their claw strength.

Şahin et al (2011) stated that there is a significant relationship between the hand-claw strengths obtained from taekwondo players and their ages in their study involving 280 volunteer taekwondo players. There was also a significant relationship between the ages and claw strength of the taekwondo players in our study. In this respect, it is seen that there is a parallelism with our study[23].

Chong et al. (1994) stated that there is a significant relationship between the forearm lengths of the subjects and their hand grip strength in their study conducted on a certain group in the People's Republic of China [24].

Melekoglu et al. (2018) stated that the relationship between hand length and hand grip strength in adolescents is important[25].

In our study, the relationship between average height and claw strength values showed changes at the level of branches. Because of this situation, it can be said that there is no relationship between height and claw strength. It is thought that this situation may be caused by living conditions such as socioeconomic status, environmental factors or athlete backgrounds among individuals.

De Ste Croix et al. (2000) included the evaluation between age and leg strength in their study. As a result of this evaluation, they found that there was a statistically significant difference between both parameters [26].

Barber-Westin et al. (2006), it was stated that leg strength increases as age increases[26]. According to the data we have obtained, there is an inverse relationship between the average age of male athletes and the average leg strength for all branches; It can be said that there is an inverse relationship between female field hawkey players and athletes in the specified branches, and there may be differences between age and leg strength between taekwondo and field hawkey players and athletes depending on the sports branch.

Kaynar et al. (2011) reported that hand grip strength is strongly related to the strength in the upper body and neck muscle groups in their study on 22 elite wrestlers[27].

Tizar et al. (2016), in their research on 45 elite basketball, handball and volleyball players, found a significant difference only in terms of Back Strength when comparing the Basketball-Handball teams in terms of strength right, strength left, vertical jump, long jump, leg strength, back strength [28].

Similarly, in our study, we determined differences in some parameters of field hawkey players and taekwondo players who have similar characteristics to the aforementioned branches. In these determined differences; it was found that athletes and field hawkey players had higher values than taekwondo players in leg strength values, and athletes had higher values than taekwondo players in back strength values. However, no significant difference was found in the claw strength values of the elite male athletes participating in the study according to their branches.

Conclusion

In this study, in which the leg, back and claw strength values of elite taekwondo players, athletes and field hawkey players were compared, the mean leg strength (kg) values of male taekwondo players were 113.5±26.5, and the mean back strength (kg) values were 108.8±9.9, claw strength (kg) values mean 41.9±5.0; Mean leg strength (kg) values of female taekwondo players were 89.7±19.2, mean back strength (kg) values were 83.4±6.3, and average claw strength (kg) values were 38.6±3.8. Mean leg strength (kg) values of male field hawkey players were 133.8±32.6, mean back strength (kg) values were 117.8±21.6, and claw strength (kg) values were average 43.8±9.1; The mean leg strength (kg) values of female field hawkey players were 76.0±2.7, the mean back strength (kg) values were 70.4±4.8, and the average claw strength (kg) values were 27.6±9.1. The mean leg strength (kg) values of male athletes were 141.3±18.1, the mean back

strength (kg) values were 126.2±9.9, the average claw strength (kg) values were 39.0±3.1; The mean leg strength (kg) values of female athletes were 78.6±21.9, the mean back strength (kg) values were 73.3±15.1 and the average claw strength (kg) values were 32.5-3.0.

There was a significant difference found in the leg strength, back strength and claw strength values of the elite female athletes participating in the study according to their branches. In these determined differences; It was found that taekwondo players have higher values than athletes in leg strength values, taekwondo players have higher values than both athletes and field hawkey players in back strength values, and taekwondo players have higher values than both athletes and field hawkey players in claw strength values. Furthermore, a substantial difference was found in the leg strength, back strength, and values of the elite male athletes participating in the study based on their branch. It was not discovered that athletes and field hawkey players had greater values than taekwondo players in leg strength values, or that athletes had higher values than taekwondo players in back strength values.

However, no significant variation in the claw strength values of the elite male athletes participating in the study according to their branches was found.

As a conclusion, elite female taekwondo players have greater back, leg, and claw strength values than elite female athletes and field hawkey players; elite male athletes have greater back and leg strength values than elite male taekwondo players.

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CASE REPORT

Root Resorption due to Occlusal Trauma and Infection

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Özet:

Bu vakada 5 yaşındaki bir kız çocuğunda izlenen periapikal enfeksiyon ve oklüzal travmaya bağlı gelişen kök rezorpsiyonu sunulmuştur. Raporda yeterli tedavi edilmemiş çürüğün periapikal enfeksiyonunun oluşup yayılmasına, uygun olmayan kavite preparasyonu ve restorasyonununun ise oklüzal travmaya sebep olduğu ve her iki etkenin birleşip, altında daimi diş agenezisi olduğu halde alt süt molar dişin kökünde rezorpsiyona yol açtığı düşünülmektedir.

Anahtar Kelimeler: Oklüzal travma, periapikal enfeksiyon

Abstract:

In this case, root resorption due to periapical infection and occlusal trauma in a 5-year-old girl is presented. In the report, it is thought that inadequately treated caries cause periapical infection and inappropriate cavity preparation and restoration cause occlusal trauma, and both factors combine and cause resorption at the root of the mandibular molar although there is permanent tooth agenesis under it.

Keywords: Occlusal trauma, periapical infection.

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Introduction

The most common causes of root resorption are; chronic periapical or periodontal infection, orthodontic tooth movement, benign and malignant neoplasms, systemic disorders, permanent tooth eruption, jaw traumas, especially occlusal trauma, and Paget's disease in the bone[1-8]. However, in the absence of any of these factors, cement, dentin and enamel are resorbed by unknown mechanisms. This is called "idiopathic resorption" of the tooth [2,3,4].

Previous clinical studies have shown that occlusal trauma associated with periodontal diseases can lead to pathological changes in the pulp of the tooth [4]. Results from animal experiments show that traumatic occlusion is not a local phenomenon alone, but an inflammatory reaction induced by local stimulant in the pulp and periodontium [5].

A case where an occlusal trauma associated with the infection was thought to cause root resorption is presented below.

A 5-year-old female patient applied to our clinic due to pain in her second primary molar tooth. The patient applied to another clinic with the same complaint three months ago, and periapical radiographs taken at that time showed caries in the mandibular first and second primary molar teeth. In the periapical radiograph taken during this period, it is seen that the right mandibular second premolar tooth is congenitally missing and there is no resorption in the roots of the primary second molar tooth (Figure 1). The patient's tooth with caries was treated with inappropriate amalgam restorations, and the patient applied to our clinic with a complaint of pain three months after the treatment of the primary first and second molar teeth. There was no significant finding in the medical and dental history taken from the patient. In the extraoral examination, the front view was normal, the oral hygiene was found to be sufficient, and no periodontal disease was detected. In the intraoral examination, secondary caries was observed in the mesial step of the mandibular primary second molar tooth, and no intraoral abscess or hyperemia was observed in the same region. In the occlusal examination, an improperly performed overhanging amalgam filling, which may cause occlusal trauma, was found in the patient's mandibular primary second molar tooth. Secondary caries finding was also confirmed in panoramic and periapical films (Figures 1 and 2), and congenital absence of the permanent second premolar tooth was detected. Despite the congenital deficiency of the permanent second premolar, root resorption has been observed in the mandibular primary second molar. Resorption is particularly significant in the mesial root (Figure 3). On the left side, although there is a permanent mandibular second premolar tooth, there is no sign of resorption at the roots of the mandibular primary second molar tooth (Figure 2). In the next

treatment of the patient, first the primary second molar tooth was extracted and a removable retainer was made to prevent mesial movement of the mandibular first molar tooth.

Figure 1: Periapical radiograph showing congenitally missing of the right mandibular second premolar tooth and no resorption in the roots of the primary second molar tooth
Figure 2: Panoramic radiograph showing overhanging fillings of the mandibular primary first and second molar teeth and congenital absence of the permanent second premolar tooth.
Figure 3: Periapical radiograph showing a significant resorption in the mesial root of the primary second molar tooth.

Discussion

There are many etiological factors leading to root resorption 1,6,7,8-20. Studies have shown that the heredity factor is important in resorption of both primary and permanent tooth roots, but it has been reported that the effect of heredity varies depending on individual characteristics and different teeth. In a radiographic study by Massler and Malone 9, they detected resorption in one or more permanent tooth roots in 100% of the individuals examined. Another finding in the study is that the amount of periapical resorption increases with age 9. Saravia et al. 10 reported two cases with identical twins and suggested that idiopathic root resorption may be related to genetics. There are quite old studies that establish a relationship between external root resorption and endocrinal disorders that affect the basal metabolic rate such as hypothyroidism, hypopituitarism, and hyperpituitarism 16,17. On the other hand, there are also studies showing that polymorphisms in the IL-1 gene 10.11 or the coexistence of IL-1 and IL-IB gene polymorphisms are at a high risk for the development of pathological root resorption 15.

In many studies, it has been reported that different levels of resorption may occur with occlusal trauma, chronic periapical or periodontal infection, and orthodontic tooth movement, in addition to the hereditary effect on root resorption in primary and permanent dentition 6,7,11,12,19. It has been reported that external root resorption often occurs as a result of chronic periapical infection and periodontal disease 11-14.

Robinowitch 18, on the other hand, states that trauma, using a high-speed tour without spraying water in cavity preparation, and deciduous tooth infections may be the cause of resorption. In this case, it is thought that the occlusal trauma due to the overhanging amalgam filling and the periapical infection that developed as a result of the secondary caries due to insufficient preparation of the caries caused root resorption. Although there is no permanent tooth germ under the mandibular primary second molar tooth, root resorption is remarkable.

In this case, it was seen that; Occlusal trauma, indirectly, can initiate resorption when combined with risk factors for periapical destruction such as dental caries and endodontic infection.

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CASE REPORT

Hypertensive Attack with Bleeding in the Anastomosis Line After Laparoscopic Colon Resection

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Özet:

Laparoskopik kolon cerrahisi giderek kullanımı artan açık cerrahi operasyona göre daha az invaziv olan bir yöntemdir. Ameliyat sonu devrede ağrının daha az olması, erken dönemde barsak aktivitesinin yerine gelmesi, hastanın iyileşme sürecinin daha erken olması gibi birçok avantajı içermektedir. Laparoskopik kolon cerrahisinde de komplikasyonlar meydana gelebilmektedir. Henüz geniş serilerin oluşturulamadığı günümüzde olgu sunumları bu konuda literatüre yardımcı olmaktadır. Olgumuzda postoperatif dönemde hipertansif atak gelişmiş ve buna bağlı intraperitoneal ve rektal kanama gelişmiştir. Replasman tedavisi ile tedavi ettiğimiz olgumuz sunulmuştur.

Anahtar kelimeler: *kolon, kanser, laparoskopi, kolektomi, rektum*

Abstract:

Laparoscopic colon surgery is a method that is less invasive than open surgery, which is increasingly being used. It includes many advantages such as less pain in the post-operative period, restoration of bowel activity in the early period, and earlier recovery of the patient. Complications can also occur in laparoscopic colon surgery. Case reports help the literature on this subject today, where large series have not yet been established. In our case, a hypertensive attack developed in the postoperative period and intraperitoneal and rectal bleeding developed due to this. We present our case who responded to medical treatment.

Keywords: *colon, cancer, laparoscopy, colectomy, rectum*

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Case:

Our case is a 70-year-old male patient. Colonoscopy was performed in our patient, who came with the complaint of constipation and weight loss, and a tumoral mass was detected in the sigmoid colon that surrounded the lumen, which made it difficult to pass the colonoscope. A diagnosis of adeno Ca was made in the biopsy, and the examinations (PET CT, Whole abdominal CT) revealed that the cancer was limited to the sigmoid colon. Ureteral invasion and peripheral organ invasion were not detected. The patient was given detailed information about open and laparoscopic surgery. The patient and his relatives consulted other centers and decided on laparoscopic surgery.

After intubation of the patient under intratracheal general anesthesia with rapid intubation, the abdomen was entered with the 5-way trocar system, and the inferior mesenteric artery and vein were clipped and cut from the origin points. The splenic flexure was released. The resection was completed within the framework of oncological rules, the ureters were preserved, and intraperitoneal anastomosis and protective ileostomy were performed after the resection. Stable findings were detected in the blood pressure and urine output arterial blood gas follow-ups during the operation, and the blood pressure was 130/70 mmHg. Before the end of the operation, the abdomen was washed with SF and it was determined that there was no active bleeding. Finally, saline was administered rectally and leak test was performed, and the given liquid was withdrawn rectally as clear.

The patient who woke up at the end of the operation was taken to the intensive care unit after being kept under observation in the operating room for a while. In the first period of intensive care follow-ups, the patient's blood pressure was stable, and there was no drainage from the drains. In the blood pressure follow-ups, a hypertensive attack approaching 220/90 mmHg levels developed in the first hour, and after the attack, hemorrhagic fluid started to come from the abdominal drains and defecation containing fresh blood developed. Intraperitoneal and intracolonic bleeding that developed after this hypertensive attack was followed up with replacement therapy, and clinical improvement was observed after 24 hours and the hemogram values were stabilized. Our patient, who did not develop any complications in his later follow-ups, was discharged with good health.

Discussion

The development of vascular occlusive devices has led to the advancement of laparoscopic surgery and its use has become increasingly widespread[3]. Likewise, the introduction of staplers into laparoscopic use has made intraperitoneal anastomoses easier. In parallel with the frequent

occurrence of colon cancer and these developments in technology, laparoscopic operations in colorectal surgery have come to the fore. Because laparoscopic operations are less invasive and less traumatizing than open surgery, laparoscopic colorectal surgery is gaining more acceptance among both patients and surgeons, and the number of applications is increasing.

If we remember the beginning years of laparoscopic cholecystectomy applications, laparoscopic surgery is now accepted as the gold standard in cholecystectomy and open cholecystectomy is not applied primarily today. It can be predicted that the same process will develop in laparoscopic colon surgery.

Since laparoscopic colon resection cannot be performed as a standard today, large series have not been established yet. We think that the accumulation of case reports in the literature in order to create large series information will accompany positive results in terms of knowledge accumulation.

Various complications may develop after laparoscopic colon surgery[4,5,6]. Among them, complications that can be seen due to untreated postoperative hypertension can be counted as myocardial ischemia, myocardial infarction, arrhythmia, pulmonary edema, stroke, and surgical site bleeding[7].

Postoperative surgical bleeding can be treated with medical or surgical methods. Surgical methods may be the first choice in major bleeding. If the general condition and stability of the patient are appropriate, medical follow-up and treatment may be at the forefront. In our case, surgical site bleeding developed after a hypertensive attack. Since the general condition of our case was good, blood pressure and pulse were stable, medical treatment was applied. Considering the deficits, replacement therapy was performed. Rectal bleeding gradually decreased in the clinically observed patient. The positive response of the hemogram values to the replacement therapy led to the continuation of the treatment. Bleeding regressed spontaneously with medical follow-up and treatment.

As a result, close monitoring of blood pressure in the postoperative period and prevention of hypertensive attacks whenever possible reduces the risk of postoperative bleeding. When bleeding develops, the treatment method to be chosen should be chosen according to the patient's general condition and hemodynamic stability.

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