

Coll. Antropol. 28 (2004) 2: 739–746
UDC 796.322:796.06
Original scientific paper

The Contribution of Collective Attack Tactics in Differentiating Handball Score Efficiency

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ABSTRACT

The prevalence of 19 elements of collective tactics in score efficient and score inefficient teams was analyzed in 90 First Croatian Handball League – Men games during the 1998–1999 season. Prediction variables were used to describe duration, continuity, system, organization and spatial direction of attacks. Analysis of the basic descriptive and distribution statistical parameters revealed normal distribution of all variables and possibility to use multivariate methods. Canonic discrimination analysis and analysis of variance showed the use of collective tactics elements on attacks to differ statistically significantly between the winning and losing teams. Counter-attacks and uninterrupted attacks predominate in winning teams. Other types of attacks such as long position attack, multiply interrupted attack, attack with one circle runner attack player / pivot, attack based on basic principles, attack based on group cooperation, attack based on independent action, attack based on group maneuvering, rightward directed attack and leftward directed attack predominate in losing teams. Winning teams were found to be clearly characterized by quick attacks against unorganized defense, whereas prolonged, interrupted position attacks against organized defense along with frequent and diverse tactical actions were characteristic of losing teams. The choice and frequency of using a particular tactical activity in position attack do not warrant score efficiency but usually are consequential to the limited anthropologic potential and low level of individual technical-tactical skills of the players in low-quality teams.

Key words: handball, attack tactics, score

Introduction

The wealth and variety of movement structures make handball one of the most

complex sport games, which elicits an integral effect and enables uniform deve-

lopment of a large number of anthropologic characteristics of the players. Numerous studies have demonstrated the role of particular motor¹, functional², morphological³⁻⁴ and psychological⁵ characteristics of the player in their situational efficiency. Tactical activity is a crucial feature of sport games, which manifests in the situational-competitive conditions and can be defined as a planned and premeditated management of all system dimensions to reach the goal, i.e. to win, within the frame of current conditions and opposed activity of the contestant. The essence of tactical activity is to usefully employ the potentials available in a way that is spatially and temporally least favorable for the opposed team. This implies optimal utilization of the specific features of each individual through allocation of the tasks compatible to his/her abilities and at an appropriate spatial-temporal moment, depending on the activity of the opposed team players. Undoubtedly, the efficiency of the implementation of tactical elements in the attack and defense greatly depend on numerous anthropologic characteristics, especially cognitive as well as motor and functional abilities. Therefore, identification of the tactical activities that predominantly define handball efficiency is of particular interest in training practice. A number of authors have tackled the efficiency of particular technical-tactical elements in handball and their impact on game score⁶⁻¹⁰, however, there are few studies of the efficiency of collective tactics elements¹¹⁻¹². The aim of the present study was to analyze differences in the utilization of particular collective tactics elements in attack activities between high-score and low-score handball teams. According to this aim it is possible to form the basic hypothesis in terms of which the statistically significant differences in the utilization of these elements in relation to teams' score efficiency are expected.

Material and Methods

Ninety of 132 First Croatian Handball League – Men (ICHL-M) games during the 1998–1999 season, or a total of 180 information providers from two teams *per* game were included in the study. Thus, study entity was the frequency, i.e. number of application of a particular tactics element on all attacks or segments of attacks by team members during the game. The attack was defined as the part of the game from coming into possession of the ball to the moment of losing the ball or scoring a goal. Attack segment was defined as part of the attack interrupted by the action of a defender or temporary loss of ball control.

The sample of variables consisted of 19 elements of the collective attack tactics describing the duration, continuity, systems, structure, and spatial direction of the attack, as listed below.

Attack duration

Number of counter-attacks (CATT): a type of attack against no organized defense meeting the following conditions:

- not more than 4 passes including the goalkeeper,
- not more than 5 seconds from having come in the possession of the ball, and
- none of the opposite team defenders is in front of the forward at the moment of shooting at the goal.

Number of prolonged counter-attacks (PCATT): a type of attack against partially organized defense meeting the following conditions:

- duration of the attack not exceeding 10 seconds, and
- not all opposite team defenders have organized their defensive activity within the system applied.

Number of short position attacks (SPA): attacking organized defense for up to 25 seconds.

Number of medium position attacks (MPA): attacking organized defense for up to 50 seconds.

Number of long position attacks (LPA): attacking organized defense for more than 50 seconds.

Number of uninterrupted attacks (UIA): continuous attack completed on initial pass by a goal or ball loss.

Number of single interruption attacks (SIA): discontinued attack interrupted on a single occasion by the opposite defense activity or forward's error, thus to be completed on the second pass.

Number of multiple interruption attacks (MIA): discontinued attack interrupted on several occasions by the opposite defense activity or forward's error.

Attack systems

Number of attack segments in game system without circle runner attack player/pivot (NO-PIV): a game system consisting of two wingers and four back court players (backs).

Number of attack segments in game system with one circle runner attack player/pivot (ONE-PIV): a game system consisting of three back court players (backs), two wingers, and one pivot.

Number of attack segments in game system with two circle runner attack players/pivots (TWO-PIV): a game system consisting of two wingers, two back court players (backs), and two pivots.

Attack organization

Number of attack segments based on group cooperation (GCOOP): partially organized attack based on group cooperation of a few players, while the position and activity of other players having no direct impact on the engaged group activity.

Number of attack segments based on basic principles (BP): organized attack performed by all or most of the players, based on elementary tactical principles of the width, depth, ball speed and successive creation of the spatial-temporal advantage.

Number of attack segments based on combinations (COMB): attack organized on the basis of combinations where all players except the goal-keeper perform position exchanges relative to player positions within predetermined actions.

Number of attack segments based on group maneuvering (GMAN): attack based on group cooperation of a few players on the principle of combinations and predetermined actions with compulsory position exchange relative to player positions.

Number of attack segments based on independent action (IA): attack based on an individual attempt to complete it through independent action.

Attack direction

Number of rightward attack segments (RIGHT): the course of the attack, i.e. ball direction from the players on the left to the players positioned on the right.

Number of leftward attack segments (LEFT): the course of the attack, i.e. ball direction from the players on the right to the players positioned on the left.

Number of central attack segments (CENT): the course of the attack, i.e. ball direction along depth line, from outside towards line players.

Tactical elements were recorded by following videotapes and games. Data in the form of respective abbreviations and graphic symbols were manually entered in the specially designed forms suitable for subsequent computer entry.

The following statistical parameters were used on basic descriptive analysis: arithmetic mean (X), standard deviation (SD), minimal result value (Min), maxi-

mal result value (Max), coefficient of variability (V%), coefficient of asymmetry (a_3), coefficient of distortion (a_4), maximal deviation of relative cumulative empirical frequency from relative cumulative theoretical frequency (max D), variable percentage in total number of game segments (VT%), and variable percentage within a respective group (VG%). Testing for normality of distribution of prediction variables was performed by use of Kolmogorov-Smirnov test at the error tolerance level of 5%.

The significance of differences within criterion groups was determined by multivariate analysis of variance (MANOVA) and canonic discrimination analysis with the respective parameters: arithmetic mean of the groups $X(L/W)$, F value to test statistical significance (F), Wilks' lambda value (Wilks' λ), respective value of the degrees of freedom (df), eigenvalues of discrimination functions (λ), coefficient of canonic discrimination (Rc), Chi-square test (χ^2), level of significance (p), and orthogonal projections, i.e. correlations of variables with discrimination functions (DF1). The entities were categorized into two quality groups according to the criterion of the game score efficiency (winner or losing team).

Results and Discussion

The basic descriptive parameters of the prediction variables are presented in Table 1. All variables showed normal distribution (Test < Max D), with a mild positive asymmetry being more pronounced in the variables of NO-PIV and IA. This was probably due to the low frequency of these variables, since the attack completion by individual action is not common, which also applies to the attack in a game system without pivot that is usually performed when there are less players relative to complete defense formation. Coefficients of variation were satisfactory, with

the exception of the mentioned variables that showed a high level of dispersion.

Among the attack duration variables, SPA showed highest (35.04%), and LPA (10.26%) and CATT (11.55%) lowest frequency. The majority of position attacks were relatively quickly performed, taking some 25 seconds, whereas prolonged attacks taking more than 50 seconds were quite rare. The percentage of counter-attacks in the overall attack structure was not satisfactory and was lower than the percentage recorded during the World Championship with a mean of 7.81 counter-attacks *per* game¹⁰. This was probably due to the higher team alignment in the ICHL-M than among the national teams participating in the World Championship. At large international contests like world championships or Olympic Games, which also include national teams from countries where handball has been quite inadequately developed as a sport game, there is strong polarization of teams according to their values, and it is just the performance of counter-attack which is one of the most reliable indicators of differences in team quality.

Concerning attack continuity, there was a predominance of UIA completed on initial pass (52.82%), mostly referring to counter-attack, semicounter-attack and short position attack, indicating the attack action outcome to be more often than not resolved during the first pass of attack.

The ONE-PIV type was the most common game system (69.06%) that can be successfully used against almost all defensive formations. The TWO-PIV system, generally used against deep defensive formations, and NO-PIV system that is primarily associated with a lower number of forward players relative to full defense formation, were less frequently recorded.

Of the attack organization variables, GCOOP based on group cooperation was

TABLE 1
BASIC DESCRIPTIVE AND DISTRIBUTION PARAMETERS OF PREDICTION VARIABLES

Variable	\bar{x}	Min	Max	SD	V%	a_3	a_4	Max D	VT%	VG%
CATT	6.78	0	19	3.68	54.28	0.73	0.47	0.11	6.93	11.55
PCATT	8.91	1	18	3.93	44.11	0.24	-0.58	0.09	9.11	15.18
SPA	20.57	7	39	5.29	25.72	0.06	0.14	0.06	21.02	35.04
MPA	16.24	6	26	3.65	22.48	0.04	0.15	0.06	16.60	27.67
LPA	6.02	0	16	3.05	50.66	0.51	-0.18	0.11	6.15	10.26
UIA	26.84	9	46	7.69	28.65	0.23	-0.58	0.07	27.43	52.82
SIA	11.84	0	20	3.82	32.26	-0.36	0.83	0.10	12.10	23.30
MIA	12.13	1	28	4.87	40.15	0.38	0.10	0.08	12.40	23.87
NO-PIV	6.51	0	30	4.79	73.58	1.59	3.78	0.15	6.65	8.29
ONE-PIV	54.24	14	105	16.19	29.85	0.20	0.13	0.06	55.43	69.06
TWO-PIV	17.79	2	52	8.86	49.80	0.88	0.92	0.10	18.18	22.65
GCOOP	40.60	20	81	10.92	26.90	0.90	1.23	0.07	41.49	44.25
BP	17.96	4	37	7.63	42.48	0.51	-0.47	0.08	18.35	19.57
COMB	19.30	4	38	6.30	32.64	0.14	-0.11	0.07	19.72	21.04
GMAN	7.95	0	21	4.70	59.12	0.58	-0.31	0.12	8.12	8.66
IA	5.94	0	29	4.11	69.19	1.75	5.39	0.17	6.07	6.47
RIGHT	29.83	15	56	8.19	27.46	0.39	-0.12	0.06	30.49	38.55
LEFT	27.96	10	52	7.82	27.97	0.30	0.04	0.06	28.57	36.13
CENT	19.59	7	41	5.73	29.25	0.76	1.90	0.08	20.02	25.32

Test = 0.17

most common (44.25%), whereas IA based on independent solitary action was least frequent (6.47%). Individual and as a rule unorganized attack against the established defense frequently reflects lower quality level or tactical inferiority of the attacking team versus defensive team. The predominance of the attack based on group cooperation over the attack based on collective activity of the whole team and basic principles (BP), the latter accounting for only 19.57%, pointed to game fragmentation, inadequate speed and smoothness of the attack, which are present to a high extent in the tactical game concepts of the top world teams in contrast to our handball teams.

Concerning attack direction, the attack directed to the right showed a slight predominance over the attack directed to

the left, accounting for 38.55% and 36.13%, respectively. The RIGHT attacks were more common because they are more suitable to perform from the technical-tactical standpoint, since there always are more right-handed than left-handed players in the team. On shooting, rightward ball distribution is considerably facilitated to right-handed players for protecting the ball with the body from the opponent defenders.

Results of the analysis of variance and canonic discrimination analysis between the winning and losing teams are shown in Table 2. The obtained discriminant function significantly distinguishes these two team categories at the 0.01 level of significance ($p < 0.01$), with average coefficient of canonic discrimination (0.60). According to these results, the basic hypoth-

TABLE 2
RESULTS OF ANALYSIS OF VARIANCE AND CANONIC DISCRIMINATION ANALYSIS OF WINNING AND LOSING TEAMS ACCORDING TO VARIABLES OF COLLECTIVE ATTACK TACTICS

Wilks' λ	df	λ	Rc	χ^2	p
0.64	19	0.56	0.60	72.66	0.00

Variable	X		F	p	DF1
	L	W			
CATT	5.89	7.80	12.42*	0.00	0.36
PCATT	9.16	8.68	0.66	0.42	-0.08
SPA	21.32	19.80	3.61	0.06	-0.19
MPA	16.45	16.15	0.29	0.59	-0.05
LPA	6.97	4.89	24.32*	0.00	-0.50
UIA	24.34	29.33	20.15*	0.00	0.46
SIA	12.18	11.57	1.11	0.29	-0.11
MIA	14.33	9.83	46.06*	0.00	-0.69
NO-RFP	6.67	6.31	0.24	0.63	-0.05
ONE-RFP	60.49	47.51	32.33*	0.00	-0.58
TWO-RFP	19.17	16.53	3.89	0.05	-0.20
GCOOP	43.48	37.89	11.69*	0.00	-0.35
BP*	20.32	15.49	18.83*	0.00	-0.44
COMB	19.60	19.02	0.35	0.55	-0.06
GMAN	8.91	6.84	8.52*	0.00	-0.30
IA	6.72	5.13	6.60	0.01	-0.26
RIGHT	32.21	27.05	19.26*	0.00	-0.45
LEFT	30.78	25.23	24.34*	0.00	-0.50
CENT	19.93	19.26	0.58	0.45	-0.08

L = arithmetic mean of losing teams; W = arithmetic mean of winning teams; *p<0.01

esis is confirmed. Individually, these differences manifested in a number of variables. The winning teams showed a statistically significantly higher predominance of CATT and UIA attack types, whereas losing teams had a statistically significantly higher proportion of LPA, MIA, ONE-PIV, BP, GCOOP, IA, GMAN, RIGHT and LEFT attack types.

The results of the study clearly showed the score efficiency to be realized by a greater proportion of fast, uninterrupted attacks and especially counter-attacks, meaning the attack efficiency to

manifest on the first pass in particular. The high efficiency of counter-attack is quite understandable^{7,9-10}, as it is an attack against unorganized defense, which is to be completed at close range, usually without the presence of defenders. The forward possesses thereby a great kinetic potential as well as a favorable shooting angle, thus ensuring considerable advantage over the goalkeeper. That is why this type of closing prevails in achieving high score differences in the games of two teams of a varying quality, and reliably polarizes handball teams efficient and inefficient in terms of game results.

The efficiency of counter-attack is in particular dependent on some anthropologic characteristics of the players such as speed strength or speed endurance, which also contribute most to the player situation efficiency¹. Along with efficient defense ensuring the basis for fast attacks, the predominance of attacks against unorganized defense in high-quality winner teams is a consequence of limited technical, tactical and physical characteristics of the lower quality opponents, where it contributes to the greater number of balls lost on attack. Anyhow, the opponent's defense appears to be less efficient at the beginning of position attack, when the attack has highest potential and greater are chances for a favorable opportunity to occur. With attack prolongation, the opponent's defensive activity is being adapted to the attack activities, especially if these are repetitive and stereotypical.

On the other hand, the variables describing long, discontinued attack activity were found on the negative pole of discrimination function, like other variables defining the system, organizational and spatial direction of tactical activity during position attack. Attack fragmentation characterized by numerous interruptions reflects highly engaged and aggressive opponent's defense play as well as limited anthropologic potentials of the players in low-quality losing teams, which they tend to compensate for by more frequent and diverse tactical activity during position attack against established defense. The increased frequency of such an attack may also be due to the tactical decision of the lower quality team to perform as long attacks as possible in order to achieve a less unfavorable score. Thus, it is evident that favorable score cannot be attained only by the high number, i.e. frequent use of particular tactical activity. Score efficiency does not depend on the number but on the quality of implementation of tactical elements, which predominantly

relies on the general and specific anthropologic characteristics of the players, and the activity of the opponent team. This hypothesis is supported by the fact that no type of the system, organization or spatial direction of the attack could be identified that would significantly differentiate the winning from the losing teams during position attack.

Conclusion

Using a sample of 90 First Croatian Handball League – Men games during the 1998–1999 season, differences in the prevalence of 19 elements of collective tactics were analyzed between the score efficient and score inefficient teams. The elements included in the study were related to the duration, continuity, system, organization and spatial direction of the attacks. Study results revealed normal distribution of all predictive variables and lower prevalence of quick attacks against unorganized defense as compared with those recorded at World Championship games. Using canonic discrimination analysis and analysis of variance, the score efficient (winning) teams were found to be characterized by short continuous attacks, especially in the form of counter-attacks, and short position attacks taking up to 25 seconds. On the other hand, score inefficient (losing) teams were found to be characterized by long, interrupted position attacks and all variables describing the system, organization and spatial direction of tactical activity during position attack. The interrupting course of the losing team attacks is primarily consequential to the limited anthropologic potential and low level of individual technical-tactical skills of these team players, which they tend to compensate for by frequent and diverse tactical activity. It is quite evident that score efficiency cannot be achieved exclusively by the repetitive use of a particular tactical element, nor it is

possible to identify any type of the system, organization or spatial direction of the attack that would significantly differ-

entiate winning from losing teams during position attack.

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DOPRINOS KOLEKTIVNE TAKTIKE NAPADA RAZLIKOVANJU REZULTATSKE USPJEŠNOSTI U RUKOMETU

SAŽETAK

S ciljem utvrđivanja razlika u prostoru kolektivne taktike napada, na uzorku od 90 utakmica Prve hrvatske rukometne lige za muškarce u natjecateljskoj sezoni 1998/99. analizirana je pojavnost 19 elemenata kolektivne taktike napada kod pobjedničkih i poraženih ekipa. Predikcijskim varijablama opisano je trajanje, kontinuiranost, sustavi, organizacija i prostorna usmjerenost napada. Analiza osnovnih deskriptivskih i distribucijskih statističkih parametara ukazuje na normalnu raspodjelu svih varijabli i mogućnost primjene multivarijatnih metoda. Kanoničkom diskriminacijskom i analizom varijance utvrđeno je da se primjena elemenata kolektivne taktike u napadu statistički značajno razlikuje kod pobjedničkih u odnosu na poražene momčadi. Pobjedničke momčadi dominiraju u protunapadima i neprekinutim napadima, a poražene u dugim pozicijskim napadima, višekratno prekinutim napadima, napadima u sustavu s jednim kružnim napadačem, napadima temeljenim na osnovnim principima, skupnoj suradnji, individualnoj akciji i skupnim kombinacijama, te napadima usmjerenim u desnu, odnosno lijevu stranu. Jasno je da pobjedničke momčadi obilježavaju brzi napadi na nepostavljenu obranu, a poražene dugi isprekidani pozicijski napadi na postavljenu obranu s učestalim i raznovrsnim taktičkim djelovanjima. Izbor i učestalost provedbe neke taktičke aktivnosti u pozicijskom napadu nije jamstvo rezultatske uspješnosti već najčešće posljedica ograničenih antropoloških potencijala i niske razine individualnih tehničko-taktičkih znanja igrača u manje kvalitetnim momčadima.