Analysis of the Japanese Men's National Water Polo Team at the Rio de Janeiro Olympics

Rintaro SONODA
Toho Junior High School, first year (seventh grade)

*This research papers and all raw data have already sent by FedEx in December directly to Undergraduate Admission Office.

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Abstract

This study was to analyze the Japanese Men's water polo team's game strategy and get tips for my own water polo team to improve. As it took 32 years for Japan's water polo team to be able to attend the Olympics, a director of Japan produced a new strategy called "pass line defenses and counter" style known as a "new water polo style." This is the style mentioned in his book (2016), and it can compensate for some of the physical weaknesses of the Japanese players. I video-taped all the games and analyzed their shooting styles, the possibilities of scoring, and the goal areas. The first section is about the history of water polo, the second section explains the rules of water polo, and the third section delves into the differences between traditional styles and the Japanese style. The fourth section covers the procedures of this research, and fifth section is about the results of my data analysis.

*This research paper was first written in Japanese as an individual summer project in the seventh grade at Toho Junior School, with which I won the first prize. I then translated into English when I was in the 11th grade and proofread and modified in the 12th grade.

This year, the Japanese men's national water polo team won the right to participate in the Rio de Janeiro Olympics.

I have been playing water polo for four years now. Since joining the swimming club (water polo club) at Toho Junior High School, it feels as if I have spent more time

in the water than on land. I am more fascinated by the depth and fun of water polo than ever before, and every time I go to a game, my desire to learn more about the game itself and its strategies grows stronger.

Water polo is a minor sport in Japan, but it was the first team sport to be registered as an official event in the Olympics. The former coach of the former water polo powerhouse Hungarian team, Bélaïki (1923), stated in the beginning of his book, "There is no sport that requires more systematic and scientific guidance than water polo. In countries like Hungary and Montenegro, water polo is the national sport. Water polo is a profound and interesting sport that continues to fascinate viewers.

Since the Olympics will be held this summer, I thought it would be a great opportunity to learn about water polo in Japan today and decided to take it up as a subject for our summer free study.

There is not much literature on water polo in Japan, but I looked through as many references as possible to find out how water polo originated, how it became the water polo sport it is today, how it spread in Japan, and how the Japanese Water-polo Team changed until it participated in the Rio de Janeiro Olympics. In addition, referring to previous research papers on water polo game analysis, I attempted to analyze the strengths and weaknesses of Japan's water polo team by examining the effectiveness of Japan's new attacking style called "Pass Line Defense" and comparing it with the strategic style of the opposing countries in the actual Olympics.〔 In addition, I attempted to analyze the strengths and weaknesses of Japan's water polo team by examining the effectiveness of Japan's new attacking style of "pass line defense" and comparing it with the strategic styles of the opposing countries.〕

1. History of Water Polo

1) From the Birth of Water Polo to Becoming an Olympic Sports

There are many theories about the origin of water polo. The first theory is that it was invented by William Wilson in 1844, and a water polo competition with three players per team was held in 1876 (Sugita, 1932). The second theory is that it was created in 1869 to break up the monotony of swimming (the originator is not known). Third is that it became an official sport as water soccer in 1870 (Laiki, 1973). The fourth theory is that it was created in 1860 because of the construction of many indoor swimming pools (Kanda, 1978). The game was played as underwater football (Yanagishita, 2016). Another theory is that

it may have originated in England as a folk festival with underwater battles in rivers and ponds from around 1600, and that some of the games may have started as spectacles after the 19th century (Takagi, 2005). Finally in 1876, players rode on a wooden horse floating on the surface of the water and used oars to control the horse and the ball to reach the goal like polo, and in 1885, the game took its current form in which players handle the ball while swimming (Omoto 1996). According to Laiki, when the game first started, it was over in a short time. This shows that it was an intense sport even then, as he states that it was because the rubber ball could not withstand the rough play. According to Omoto (2016), the speed of a shot taken by jumping up and down in the water can exceed 80km.

According to many documents, water polo at the time of its birth as a sport was far different from what it is today. It was a rugby type of water polo, and the score was scored when the ball was placed in the goal area, so it was a game of fierce defense with repeated tackles near the goal area. In 1899, the International Water Polo Rules were enacted, which have become the basis for the modern rules.

In the United Kingdom, the birthplace of water polo, water polo has long been a school sport, and in 1882, a men's water polo team was established at Cambridge University, and in 1891, a rivalry match was held with Oxford University. It is well known that Prince William, the current member of the British Royal Family, was a member of the water polo team at Eton and St. Andrews Universities, showing that it is still a popular sport in Britain.

Next, I will briefly summarize how water polo was introduced to countries around the world after the ASA (Amateur Swimming Association) established uniform rules in the UK in 1888. The first country where water polo was introduced was the United States. This was in 1888. John Robinson from England introduced the sport at the American Athletic Club, but the Americans loved this rugby style of water polo so much that it became much more dangerous than the one introduced by Robinson. However, this style of water polo became more popular in the U.S. because of its more intense goal scoring and defense, and the second official national championship held at Madison Square Garden in 1899 attracted 14,000 people. Water polo in the U.S. was called "American water polo" and continued to be distinguished from the water polo that originated in England.

Next, we move to Germany. Fritz Knize, who had studied water polo in London, introduced the sport when he returned to Berlin. At first, the sport was not well received, but when he gave a lecture and showed how water polo was played,

there was a great deal of interest, and in 1898, Ulrich Baer created a rule book in German. In 1898, Ulrich Baer created a German version of the rule book, but since the rule book was created in a different year, the content of the rule book differed in several ways. In addition, German water polo lagged behind the soccer-type water polo that was being played in England at that time. Therefore, German water polo was no longer interesting for spectators and players alike. Because of this, Mr. Draemer created his own rules, such as banning dribbling, to make it more interesting. However, in Germany, many teams tried to follow the British rules, and the original rules did not spread much. (This plethora of rules caused confusion during games, so the rules were unified in 1904.)

After water polo made its way to Germany, it spread to Belgium. (It is said that Belgium was very aware of what sports were popular in England at the time). It was in the late 1890s that many Belgians became extremely interested in the sport. In the late 1890s, there was a strong movement to develop water polo culture, and many games were held with the British. Water polo was introduced at the Belgium World Exposition. You can clearly see that Belgium is putting a lot of effort into water polo. Furthermore, while the interest in water polo was growing in Belgium, it was soon transmitted to France (1896 to 1898). This was triggered by the interest of Léon Berdeau (France), who watched the Belgian games, after which Berdeau enthusiastically promoted water polo. As a result of his efforts, regular games with Belgian teams and competitions in northern France began to take place (1898). In the same year, water polo, which had developed only in northern France, finally spread to the capital, Paris through the work of Paul Barchet. However, France was far behind in the construction of their swimming pools, many of which were considered unhygienic. As a result, water polo in France would lag.

Finally, water-polo spread to Hungary. It all started when Fuselesi Árpád, a lawyer in Hungary, learned about water polo in a British swimming magazine he was reading to learn about the world situation. He became interested in the sport, so he ordered a rule book from England. In a sense, this was a coincidence, but Hungary is now a water polo powerhouse thanks to Arpard. Later, he made various tools for playing water polo (1897). In the first model match in Hungary, which ended in a 1-1 draw, the spectators, who had thought of water polo only as a minor part of underwater sports, were attracted by the fun of this sport. However, there was no further development, and the sport stagnated again. Unable to stand by and watch, Baratni Kahloi, who was known for swimming all the way across Lake Balaton, played a match against a team from another country. The first match was against Austria, and they lost

14-0, which made them realize the difference in power and environment from the rest of the world. Incidentally, it is said that the Austrian ball was heavier than the Hungarian ball, which caused many Hungarian players to have leg cramps. Hungarians tried to spread water-polo, but the stagnation of water-polo was inevitable, since they did not win matches very often. Water-polo in Hungary began to decline, but the turning point came in 1903. With the formation of the unified swimming division MASZ (Magyar Atletikai Szovertseg), a movement grew to hold a national championship in water polo as well. This finally happened alongside the creation of a national championship rule book in Hungarian. Later, it stagnated once again due to violent play caused by the lack of a water retreat rule, but the country is now a powerhouse, partly because twenty clubs have since been combined to form an institution independent of the MASZ.

As a result of the above history, it was adopted for the first time as an official team event at the 1900 Olympic Games. Then, in 1911, the International Swimming Federation FINA (Federation Internationale de Natation) created a unified set of rules because of various issues that came up at the Olympics. However, the rules have since changed due to the circumstances of each country, and they are now unified.

2) History of Water Polo in Japan

According to Chuji Sugita, water polo was already being played by some foreigners living in Japan when YARC (Yokohama Amateur Rowing Club) in Yokohama and KRAC (Kobe Regin & Athletic Club) in Kobe were founded in the early Meiji era. Japanese people came to know about the game around 1915 or 1916, due to the efforts of Mr. Leonard James, a businessman living in Kobe at that time, and Mr. Tilson Weed of Keio University. James is said to have distributed the booklet "Water Polo Rules," which was produced in England, to schools nationwide through the Osaka Mainichi Shimbun. Mr. Weed introduced the council to the Keio University swimming club and worked to promote the sport. On August 15, 1915, the first water polo match in Japan was held between the Yokohama Foreign Team and the Keio University swimming team. The result was a 7-0 defeat for the Keio team. Despite the efforts of these two influencers, the number of water polo teams in Japan did not increase at first. Incidentally, according to Ohbuchi (2008), before the British water polo was introduced to Japan, there were games similar to water polo called "Uchikyu-gigi" and "Saiuri-tori" invented by Jigoro Kano in 1898 which later proved to have strengthened the practice of sports similar to water polo.

However, on August 14, 1924, the National Secondary School Swimming Meet

was held at the Kaneko Pool in Tokyo, and when a mock water polo game was shown there, increased people became fascinated with the sport. Swimming pools began to be built all over the country, and water polo teams gradually began to emerge. In 1925, water polo was recognized as an event at the second Meiji Jingu Athletic Meet, and on October 12, a four-team competition was held at the Tamagawa Pool in Tokyo City, with the Tokyo Water Polo Club winning the championship. In 1926, the national tournament was also held in Kyoto, where Waseda University won the championship.

In 1927, water polo joined the National Student Aquatics Championships as an open competition along with diving, and the Japanese Championships began. After the International Aquatic Games were held the following year, the "World Record Setting Association" formed a Japanese team and a foreign mixed team to compete against each other.

In 1929, the crew of the Suffolk, a ship chartered by the Duke of Gloucester, played against the Waseda-Keio team at the Waseda pool. From that year, the name "water polo" was changed to "Suikyu" in Japanese. In 1930, water polo was added as an exhibition game for the first time at the Far Eastern Games held at the newly built Meiji Shrine swimming pool, and in the same year, water polo became a type of water sport in the Waseda-Keio match. In August of the same year, the Ministry of Education organized a water polo tournament, and the sport was introduced at a swimming instructors' seminar held by the Ministry of Education. The first Women's teams were also established around this time.

In 1931, the Japanese team was able to qualify for the following year Olympic Games. 14 members were selected from the teams of Waseda, and Keio universities based on their performance in all competitions throughout the year to form the first Japanese national team. In 1932, at the final qualifying round of the Olympic Games, nine members qualified in what was a consequent milestone in the history of Japanese Water polo. Sugita (1923) wrote enthusiastically about those days, "Water polo in Japan, under the complete control of the Japan Water Polo Federation, after years of endurance and suffering, is now taking its first steps toward a glorious history with a bright future ahead.

Year Over view

Table 1: The evolution of water polo from its birth to becoming an Olympic sports

Year	Overview
1860	There are many rumors about this date being the moment the sport was invented, but no real proofs.
1869	It is believed that water polo was invented by William Wilson, a Scottish swimming coach.
1870	Water polo rules drafted in the United Kingdom.
1876	The Bournemouth Rowing Club started to work out the rules.
1880	A series of game between England and Scotland were held, establishing a lasting rivalry.
1888	Ireland accelerates club organization and participates in competitive series.
1890	Reaches the US where indoor pools are used with a new rule that a point is scored if the player touches a mark on the wall instead of the goal net. Because of the different rules, this new variation was called “American Water Polo” or “Soft American”, distinguishing it from official water polo.
1899	Rules revised in the UK, spurring popularity First exhibition match to be held in Hungary
1893	Water polo becomes popular in Germany and throughout Europe. Popularization also begins in Australia.
1897	The sport was also launched in earnest in Hungary. Because Hungary has many heated swimming pools, club competitions are held throughout the year, and later develop into a national sport.
1900	Recognized as an official event at the second Olympic Games in Paris, Great Britain wins for the first time.
1901	Full-scale competitions held for the first time.
1901 ～1928	A period in which the sport representatives neglected to make evolutionary efforts in the creation of rules, hindering the development of the game.
1928～ 1950	A period during which rule revisions in Europe are being mooted
1950	The rules of water polo were revised by the International Swimming Federation's Water Polo Commissioner, and the year was called a turning point for water polo.
2000	Women's water polo becomes an official event at the Sydney Olympics (From "Laiki's Water Polo" by Laiki and "Water Polo" by Kand.).

Table 2: History of Water Polo in Japan

Fiscal year	Overview
1910	Keio University professor Weed introduced water polo to the university's swimming team.
1925	Swimming pools are built all over Japan, more universities and private teams start playing water polo, and it becomes an official event of the Meiji Jingu Athletic Meet, won by the Tokyo Water Club.
1927	Keio, Waseda, Takushoku, Nihon and Meiji Universities participate in the Japan National Student Water Championships, with Keio University winning the championship.
1932	Water polo" by Tadaji Sugita was published.
1932	Japan's National Water Polo Team Participates in the Los Angeles Olympics for the First Time
1950	The rules of water polo were revised by the International Swimming Federation's Water Polo Commissioner, and the year was called a turning point for water polo.
1959	Participated in the Paris Universiade.
1960	Participated in the Rome Olympics
1961	Participated in the Yugoslav Universiade.
1963	Participated in the Port Alegre Universiade
1964	Japan's Water Polo Team to Participate in Tokyo Olympics
1965	Participated in the Budapest Universiade.
1968	Japan's water polo team participates in the Mexico Olympics, defeating Greece and the Arab League, but finishing 12th.
1972	Japan's Water Polo Team Participates in the Munich Olympics
1973	Translation of "Water polo" by Hungarian water polo coach Bela Raiki published
1977	Junior high school, high school and private teams participate in the Japan Swimming Federation's National Junior Olympic Games for the first time.
1977	Participated in the Universiade in Sofia
1978	New edition of "Water polo" written by Akira Kanda is published.
1978	A chapter on water polo was published in "Sports System Vol. 14" (by Toshio Asami and others, Kodansha).
1979	Participated in the Universiade in Mexico
1981	Japanese Junior Athletes Participate in the First World Junior Championships in Italy for the First Time

1981	Participated in the Bucharest Universiade
1981	Japanese Junior Athletes Participate in the Second World Junior Championships in Barcelona for the First Time
1983	Participated in the Edmonton Universiade.
1984	Japan's water polo team participates in the Los Angeles Olympics (moved up with Canada and Brazil due to the boycott by Hungary, the Soviet Union, and Cuba).
1985	Participated in the 3rd World Junior Championships in Istanbul.
1985	Participated in the Kobe Universiade.
1996	"Water Polo Manual: From Basics to Practice" published by Hirotsugu Omoto.
2011	Participated in the Shanghai Swimming Championships in China, passing the preliminary league and advancing to the final tournament for the first time, finishing 11th. (15th in China, 13th in Kazakhstan)
2012	Lost to China and Kazakhstan in the Asian continental, not qualifying for the London Olympics,
2012～	The seven players who had represented the team above (and who would represent the team at the Rio Olympics) placed third and did not qualify for the Games, began training in professional leagues overseas and began to focus on training Japanese university water polo players. Before the Games, a long-term training camp for the national team is held for the first time.
2015	Won the Asian Championship and Rio Janeiro Olympic Qualification to qualify for the Games.
2016	Japan's Men's Water Polo Team to Participate in Rio Janeiro Olympics

* Extracted and prepared by C Sugita. *Suikyu: Water Polo*. Suinansha,1932 and A. Kanda. *Suikyu.* Baseball Magazine Company, 1973 and Ed Baseball Magazine Company. *Poseidon Japan Ouen [support] Book. Baseball Magazine Company, 2016*

2. The Game of Water Polo

Water polo is often referred to as an underwater martial art in Japan. Since water polo is played in water more than 1.8 meters deep, swimming ability is essential. The swimmer must be particularly good at doing the eggbeater kick. It is necessary to learn four swimming techniques: crawl, back, butterfly, and breast, including ankle swimming. Furthermore, “water polo differs from other sports in that it requires the same kind of performance as competitive sports on land, such as manipulating the ball, jumping, and stopping in water where it is difficult to control the body. As a result, movements that anticipate the situation are required to a greater extent than movements that respond to the situation" (Tada 2006). In the water, where there is no support, the athlete needs to have the body, arm, and leg strength to maintain himself, and the skill to handle the ball freely. In addition, it is a sport that requires the mental strength to aggressively "attack" players who are bigger than you and make them lose their balance.

One goalkeeper and six players. The team consists of three forwards, three backs and six substitutes. Teams of seven players compete against each other on a field of up to thirty meters in length and twenty meters in width, crawling in the water with their heads up (front crawl), dribbling the ball as in soccer, or throwing and retrieving the ball with one hand as in handball. The purpose of the game is to shoot the ball into the goal. All goals are scored as one point, and each period lasts 8 minutes, revised from 7 minutes in 2006. The winner is the one who scores the most points within these 7 minutes period (4 minutes for junior high school students). The attack time is set at 30 seconds from the time the player has the ball to the time the player shoots, and the player cannot keep the ball longer than that.

Due to the nature of the game, it is played man-to-man. Therefore, it is easiest to score when you attack with a numerical advantage over your opponent. This numerical advantage can be gained by counterattacking, where the defending team takes the ball, and quickly passes the ball towards the goal before the opposing team's defensive system is in place, or by retiring from the field for 20 seconds when a foul is deemed intentional. There are two types of foul play.

In addition to retreating from the water, other offenses include swimming over an opponent's legs or back or touching an opponent's head or shoulders to steal the ball. However, because water polo is an underwater game, "the referee cannot see what the players are doing in the water, so judgments are much less precise than in athletics. Also, water polo, like rugby, allows the referee to directly attack the player holding the ball, so the game is

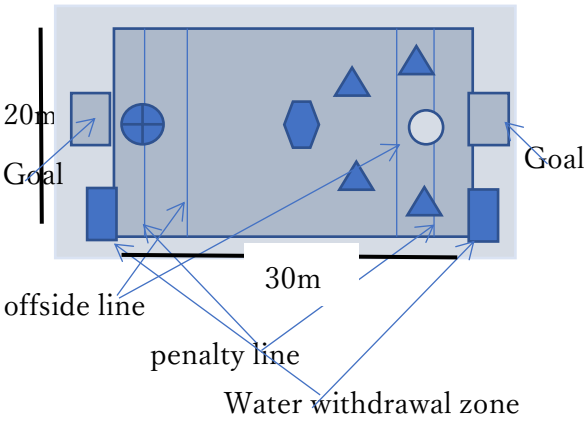
greatly influenced by the referee's subjectivity" (Omoto 2016). In fact, in the water during a match, there are many things going on, such as grabbing, kicking, and sinking opposing players.

Water polo also has a system of player substitution unlike any other sport. Any number of players can be replaced at any time, not only by the coach, but also by the players themselves, who can raise their hands to request a change. Tada's research (2006) noted that "even physically and technically excellent players find it difficult to perform well if they are psychologically weak. In other words, without a good psychological state, it is not possible to perform at a high level. Performing in environmental conditions that are different from other sports such as water polo requires a high level of physical and mental toughness to overcome the harsh environmental conditions". As an underwater sport, water polo is an environment in which it is difficult to control oneself, and this may be related to the fact that it is a sport in which a slight mental blur or physical fatigue can lead to a drop in performance. In fact, during the qualifying rounds for the Rio de Janeiro Olympics, Omoto declared, "You can change at any time, and if you feel even a little uneasy physically or mentally, be brave and change. Even if it is just for a minute to change your mind. Don't continue the game in a foggy mood." (2016) and sent the players off. Some players asked to be replaced not because they were in a negative mood, but because they wanted to bask in the afterglow of a good shot. It can be said that the Japanese national team contributed to the performance of the players by keeping their bodies and minds in good condition by taking many opportunities to change themselves.

1) Rules of Water Polo

Water polo has quite a few complicated rules, so I will spare you the details and describe the basics here. For details, please refer to the handbook published by the Japan Swimming Federation in 2006.

First, let us start with the formation. As shown in Figure 1, there is a penalty line, an offside line, a goal and a retreat zone, and each of the seven players has a position. the roles of the seven players are as follows



2) Positions and Roles

; As a floater, a player who takes a position in front of the opponent's goal as a center forward and shoots after receiving a pass from a teammate. It is said that this position requires the most physical strength because it is a very fierce battle in front of the goal.

- represents positions known as the driver. The players on the left and right fronts are called wings, and the players down the left and right sides are called flats. Ideally, a right-handed player should be on the left side and a left-handed player on the right side.

- represents a position known as the floater back, the player who holds back the opponent's floaters. In a set offense (attacking after forming a formation rather than countering), he acts as a game maker.

- represents a goalkeeper. A player who protects the goal. The only player who can use both hands at the same time.

Note that if a shot on goal goes over the goal pole and misses, it is out, and the game is restarted from the goalkeeper's throw. If the keeper touches the ball and it goes out, the team that shot it can continue to attack by throwing the ball from the corner.

For your information, the positions and names of the players in the Japanese national team this time are as follows.

Table 3: Positions and names of Japanese players in the Rio Olympics

Positions	Names	#s
Goalkeeper	Katsuyuki Tanamura	1
Driver (Left)	Seiya Adachi	2
Driver (Left)	Mutsumi Arai	3
Driver (Right)	Mitsuaki Shiga	4
Floater	Akiyoshi Yanase	5
Floater back	Junshi Iida	6
Floater& Camptain	Yusuke Shimizu	7
Driver (right)	Tomoyuki Kadono	8
Driver (left)	Shouji Takei	9
Floater back	Kenya Yasuda	10
Driver (Right)	Keigo Okawa	11
Driver (Right)	Shouta Hazui	12
Goal Keepter	Takeki Fukushima	13

From Poseidon Japan Support Book, (Baseball Magazine, 2016)

3) Penalties

Foul play is divided into two categories: auditory fouls and personal fouls. The former includes touching the ball with both hands, handling the ball with a clenched fist, not shooting within 30 seconds of the start of an attack, interfering with a competitor who is not in possession of the ball, unreasonably delaying a free throw, goal throw, corner throw, swimming over an opponent, getting within 2 meters of an opponent's goal before the ball (offside)

(When an opponent has the ball, sinking the ball gives the attacking team the right to attack), and putting the feet on the bottom of the water. Both offenses give the opposing team the right to make free throws.

The latter is a more serious offense and is further divided into two types: exclusion fouls and penalty fouls, which not only result in the awarding of free throws to the opponent, but also ineligibility to play for 20 seconds (ejection). If the foul is repeated three times, the player will be permanently ejected and will not be able to play in that game. The main offenses are grabbing and sinking a competitor who is not in possession of the ball; interfering with a free throw, goal throw, or corner throw; blocking an opponent's passing shot with both hands outside the opponent's penalty area; touching the goal line; and "intentionally" hitting or kicking an opponent. A penalty foul is an act of "intentionally" hitting or kicking an opponent. Penalty fouls are committed to prevent this exclusion foul from scoring to a teammate's goal.

3. Differences between traditional strategy and Japan's new strategy

Here, I will explain the tactics described in "Laiki's Water Polo" as the orthodox way of attacking and the tactics of non-Japanese teams that follow now.

According to Laiki's book, in most cases, he advocates a Press defense that prevents shots from being taken, but when a shot is about to be taken (within two meters of the goal in the shooting area) or when the opponent has a numerical advantage (when retreating from water or on the counter), he advocates a zone defense that reduces the shooting range and makes it harder to score. In other words, when the opponent has a numerical advantage (i.e., when retreating from the water or on the counterattack), he should try to cut off the opponent's shot course by handing up (i.e., raising his hands above the water to cut off the ball when shot). Incidentally, the world's (not Japan's) national water polo team still uses this tactic.

Now, what about Japan? Japan uses this tactic only when retreating from the water, but compared to the rest of the world, they are using a quite different method.

According to Omoto, Japan had been using the same method of defense, but now they have introduced a new method of passing line defense, which is based on the characteristics of the Japanese people, who are inferior in height and weight compared to the world's strongest nations. This is a method of getting between the ball carrier and the rest of the opponents to either prevent them from passing or force them to cut off the pass and then counter and shoot. (See Figure 3.) This method, however, requires a great deal of swimming ability to keep up with the opponent. In addition, since this strategy is more suitable when the opponent is on the offensive, it is not easy, and is quite a difficult technique, because if the opponent is not marked well, the opponent can overtake him and score a point. However, Omoto fought a practice match against Kazakhstan a month before the Olympic qualifying round by sealing the pass line defense and lost badly, which led the players, coaches, and staff to decide to fight in this way (Omoto 2016). It is believed that by introducing this new technique, which no other country was doing, the team made it through the Asian qualifiers in 2015.

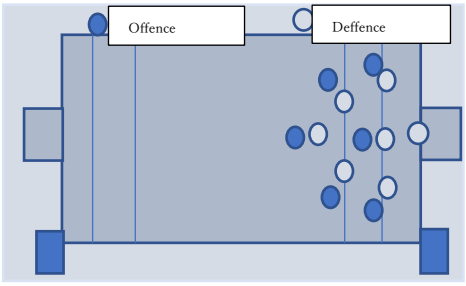


Fig 2 Normal defense

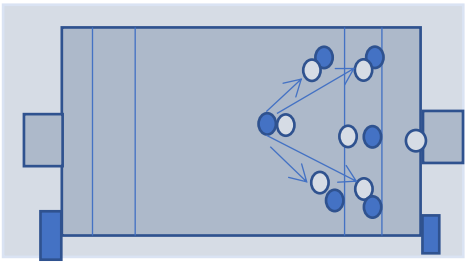


Fig 3 Path Line Defense

4. Research Methods

1) Material Collection

I decided to base my research on officially published books and articles. However, gathering these materials was more difficult than I had imagined. I went to a bookstore to purchase the necessary books, but besides the section on swimming, I came up empty. The only water polo book I could find was the latest book, "Super Aggressive" by the coach of Poseidon Japan, which was published this year. So, with the help of my parents, who are members of the National Diet Library, I searched through the NDL (National Diet Library Search System) and found that, as shown in Table 3, not only were there extremely few books on the basic material compared to other sports fields, but most of them were already unavailable for purchase. Even if the books are stored in the library, high school students and younger people need to apply in advance for direct access, and it takes 10 to 20 days or more for approval. In addition, since the library does not lend out the materials, only a portion of the materials can be copied for a fee, if the copyright allows. In the meantime, I searched for research papers using the NDL from my home PC, I printed the papers that I could print at home and requested the National Diet Library through the NDL for all papers that could

only be obtained through a printing and mailing service.

As for the reference books, I asked my mother to go to the National Library to browse and make copies of the books that were available only in the library. I also went to the Tokyo Metropolitan Library in Minato Ward, where even junior high school students can browse, to search for and browse related books. In the process, we found out that the library of the National College of Fitness and Sports of Japan (Setagaya) was open to people outside the university, so I contacted the library directly, confirmed that they had the books in advance, and went there to borrow them. It took me several days to sort and obtain all the materials I could find, and five days to complete the file with the table of contents and articles. After that, I read about thirty research papers on water polo and about ten necessary books that would be helpful for this research, while adjusting my study time and practicing with the water polo team almost every day.

Sport (arbitrary order)	Research Thesis Articles	Magazines, Journal
Waterpolo	282 (Including thirty-five thesis)	291 (Including ten published books)
Swimming	3512	7059
Table tennis	722	2260
Gymnastics	6002	16959
Valley ball	2732	3280
Wrestling	446	1182
Rugby	2130	3262
Judo	4257	6966
Canoeing	379	1204
Track and field	17524	15669
Rhythmic gymnastics	290	526
Badminton	647	967
Artistic swimming	121	96

Table 4: NDL search results (water polo and other major events that won medals at the Rio de Janeiro Olympics)

2) Analysis Procedure

Among the existing research papers on the analysis of water polo games, it was determined that the method of analysis using objective data developed by Enomoto (1995) and Takahashi et al. (1998) would be the most appropriate for the investigation of the present analysis, and an analysis sheet was developed based on the sheet used in that paper (Fig. 4). The items were the same as those developed by Enomoto and Takahashi, with the addition of pass line defense. In the original record, due to space constraints, were circled in red those cases where Japan's pass line defense was used in the zone defense. I recorded and analyzed all of Japan's games in detail to see how well the new attacking style of pass-line defense worked against the European powerhouses in the actual Olympic Games. I also attempted to compare Japan's tactical style with that of its opponents.

(1) Create an Offensive/Offensive Analysis Sheet:

Create a sheet based on items such as attack time, shooting status and type (during set offense* and by retreat) penalties, remaining time, style of opponent's defense, scoring, etc.

Analysis sheet

					Pattern of Shooting					Pattern of shooting																	Defensing Position			Point
		Japan	Opponent TEAM	Attack Time	Set Offence					During Exclusion fouls period																				
	Remaining time of game				Middle	Floater (Center)	Cut-in	Etc.	Counter	Right side Position	Left side position	Right side position	Left side position	Right side position	Left side position	Penalties	Etc.	Goal	out	Conner	Bar Post	Bar Post Rebound	Keeper	Keeper Rebound	defense	Defense Rebound	Press Defense	Zone Defense	Etc.	
1																														
2																														
3																														
4																														
5																														
6																														

Fig4: A Sheet for analysis

(2). Explanation of the Terms Used in the Analysis Sheet

-Middle shot: A shot taken from more than five meters away from the goal.

-A floater shot: A shot that is taken right in front of the goal by holding back the defense so that the defense cannot get the ball.

-Cut-in: When the floater is not in front of the goal, or not in the game, another player in another position shakes off the defense, swims toward the goal, receives the ball from another player, and shoots.

-Counter: To take the ball when the opposing offense is attacking, and quickly pass the ball to the opponent's goal before the opposing team's defensive system is set up.

-Set offense: A method of attacking from your own position, passing the ball around and trying to shoot. After typing out, resume the game in this style.

-The offense will be in the top right, top left, right side, left side, right post, and left post positions (see Figure 5).
-Goal: When you score a goal.

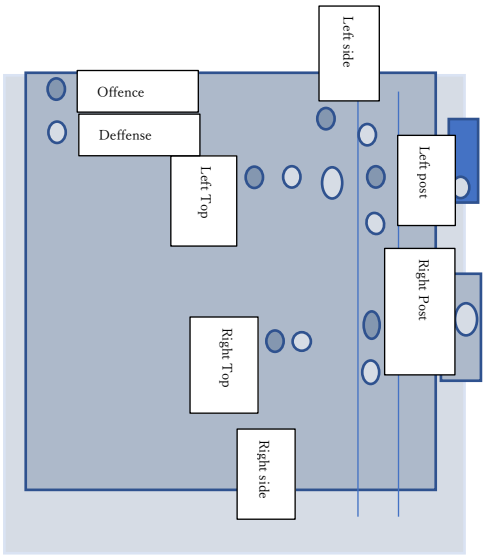


Fig 5　Set position when exiting the water

-Out: When the ball goes out without touching the bar post or the keeper. When you hit the bar post and you are out.

-BP: Rebound: When the ball hits the bar post and is returned to the field.

-Keeper: When the keeper stops a shot.

-K- Rebound: When the keeper repels the shot and the ball returns to the field.

-Defense: When a shot is stopped by the defense.

-D- Rebound: When a shot is stopped by the defense, but the ball is still in the field.

【Defense】

(1) Press Defense: Press means Pressure. A defense that pushes the opposing offense into the opponent's territory. Because of the Pressing strategy, the defense is more aggressive, cutting rather than protecting the goal.

(2) Zone Defense: A strategy in which the defensive area of a team is divided into zones (regions, areas) without specifying the opponent to be marked, and the defensive player takes charge of his own zone.

(4) Passing line defense (Japan's unique attack): An aggressive defense in which the player gets in between the opponent and the opponent's passing course, attempts to cut off the pass, and then counters.

(3.) Creation of a Shooting Position Analysis

I adopted the Latko-Rudici classification method used by Takahashi et al. in their game analysis to analyze shooting positions. This is as follows: vertically, a line is drawn parallel to the goal line at 2m, 4m, 7m, 11m, and 15m, and divided into six sections from the top: A, B, C, D, E, and F, where F refers to all fields after the half line. In the horizontal direction, two lines are drawn from the goalposts to the sideline and the midpoint of the sideline, and the classification is divided into five sections from the right: 1, 2, 3, 4, and 5. The "3" is the position of the goal.

	5	4	3	2	1
A					
B					
C					
D					
E					
F					

Fig 6: Shooting Position Analysis Chart

(4). For the Shooting Course Analysis

I referred to the shooting course table by Suh (2012) and added a new "armpit" course. As shown below, the framework is considered to be the goal, and the classification is based on the assumption that the goalkeeper is in the middle.

Top-Left	Overhead	Top-Right
Bottom-Left	Underarm	Bottom-Right

Fig 7 Shooting Position Analysis Chart

(5). Recorded all of Japan's Games in Rio de Janeiro.

For the game against Serbia, which was not televised, contacted NHK to check

the time of the missed service on the web and recorded it on video.

(6). Fill in the Chart

Using #1 and #3 on the recording chart, and #4 on the video recorded games, accurately recording each game, shot by shot, with repeated replays.

(7). Confirmation on data

As a confirmation process for #3, I replayed and referenced all the data tables and the video of each match to double-check.

(8). The following tabulations and analyses were performed

a. Overall Analysis

b. Comparative analysis of each country by shoot

c. Analysis of shoot positioning for each country

d. Analyze the shooting course of each country

Table 5: Japan's water polo opponents and schedule

Game day	opponents	
August 6	Greece	NHK 1
August 9	Brazil	NHKBS 1
August 10	Australia	NHKBS 1
August 12	Hungary	NHKBS 1
August 14	Serbia	NHKBS 1

5. Analysis Results and Discussion

Japan is characterized by its counterattack and its defense by a technique called pass-line defense. I analyzed the shooting situations and defensive styles of each match at the Olympic Games in Rio de Janeiro to see how significant Japan's defense technique was, and how much was held back by the opponent's defense.

1) Japan vs. Greece [7-8] Defeat

(1) Japanese Offense

<Characteristics of Japan's offense skill against Greece>

As for the number of goals, as shown in Table 6, in the closest game of the five games against Greece, three goals were scored on the counter, accounting for 43% of the total. In addition, the success rate was high at 50%, indicating that this was one game in which Japan's unique counter skills proved effective. Goals by penalty when leaving the water accounted for 43%, and the success rate from penalties was 50%, so they made the most of our opportunities, but in reality, penalty goals should be scored 100% of the time, so it could be still said that the Japanese team lacks scoring ability. We also failed to make the most of our superiority in numbers, with 29% decisions rate coming from out-of-water situations.

The most common shot for Japan is the middle shot, with ten shots, accounting for 36% of all shots. However, the success rate is extremely low at 10%. The middle shot was blocked in the game against Greece, and Japan had to shoot in desperation when they could not defeat a solid defense and had little time left.

<How did Greece hold off Japan's middle shot?>

As Table 7 shows, Greece used 100% Press D against Japan's middle shots and scored only once.

(2) Overall Analysis of Types of Shots and Defenses

Table 6: Type of shot and probability of goal (Japan)

Shooting style	Shoot taken	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	10	36.0	1	14.3	10.0
Floater	1	3.5	0	0	0
Cut-in	1	3.5	0	0	0
Other	1	3.5	0	0	0
Counter	6	21.4	3	43.0	50.0
Wet shot	7	25.0	2	28.5	28.5
Penalty	2	7.1	1	14.3	50.0
Total	28	100.0	7	100.0	25.0

Table7: Greece's Formation and Result at the Time of Japan's Middle Shoot

Quoter		Defensive formation	Outcome		
1 Q	1	Press D	Corner	×	
1 Q	2	Press D	Keeper	×	
1 Q	3	Press D	Out	×	
2 Q	4	Press D	Keeper	×	
2 Q	5	Press D	Bar post (BP) out	×	
3 Q	6	Press D	Out	×	
3 Q	7	Press D	Goal	○	
3 Q	8	Press D	Keeper	×	
3 Q	9	Press D	Out	×	
3 Q	1 0	Press D	Out	×	

Table 8 ：Type of Shot and Probability of Goal (Greece)

Shooting Style	Number of shots	Percentage of total shootings %	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	1	4.7	1	12.5	100.0
Floater	7	33.3	1	12.5	14.2
Cut-in	4	19.0	2	50	50.0
Other	1	4.7	1	0	100.0
Counter	1	4.7	1	13.0	100.0
Wet shot	7	33.3	3	38.0	42.8
Total	21	100.0	8	100.0	38.1

(2) Greek Offense

< Characteristics of Greece’s offense skill>

As shown in Table 8, Greece shot twenty-one shots, which is less than Japan, and scored eight goals, with a conversion rate of 38%, which is much higher than Japan's conversion rate of 25%. Out of the shots taken, floaters and outside water shots were most common, especially out-of-water goals with a scoring rate of 43%, taking advantage of their out-of-water personnel advantage. On the other hand, the success rate for floaters was low at 1 out of seven shots, or 14%, suggesting that Japan was able to keep floater shots at bay.

Table 9 Japan’s Formation and Results During Greece's Floater Shoot

Quoter		Defensive formation	Outcome	
1 Q	1	Press D	Goal	○
2 Q	2	Press D	Keeper	×
2 Q	3	Press D	Keeper Rebound	×
3 Q	4	Line D	Out	×
3 Q	5	Press D	Keeper	×
3 Q	6	Press D	Keeper	×
3 Q	7	Line D	Keeper	×

＜How was Japan able to limit the Greek floater shots to 14% accuracy?>

As Table 9 shows, Japan limited Greece’s successful floater shots to one goal. Since after the first goal, the keeper kept blocking the shots, Greece did not attempt any shots in the fourth quarter. This indicates that Japan's countermeasures

against floater shots were effective as well as their Press defense.

2） Japan vs. Brazil [8-16] Defeat

（1） Japanese Offense

<Characteristics of Japan's Offense Skill Against Brazil>

As shown in Table 10, Japan's shots against Brazil were mostly midrange shots with sixteen shots, accounting for 41% of the total. However, the number of goals scored was only two, and the success rate was only 12.5%. The Brazilian defense kept them at bay. In this game, Japan's attempt at outside water shots was second highest, with nine, which was 23% of the total. However, they scored only two goals and had a low success rate of 22.2%. Japan failed to take advantage of their high number of players. Counter-attacks, Japan's forte, were the third most frequent with 5 shots, 12.8% of the total, but they scored 2 goals and had a relatively high success rate of 40%. Japan had thirty-nine shots, 1.8 times more than Brazil, but scored eight goals and had a low success rate of 20.5%. Japan's offense was unable to counter Brazil's quick return to defense, and they were unable to defeat their opponents due to their predictable repeated pattern of passing the ball around and then hitting a mid-range shot as time was running out.

<How Brazil Prevented a Mid-Range Shot by Japan>

As Table 11 shows, most of the shots were blocked by the keeper, or hit the goal pole, making it easier for the keeper to spot and stop. In addition, of the sixteen shots taken, there were 3 BP Rebounds and three outs, so the accuracy rate also decreased. This is not to say that the loss of the first game did not have a negative psychological effect on the players. In addition, unlike the previous game against Greece, Japan is playing zone D, but the success rate is higher here, indicating that the effective defense for Japan seems to be Press defense.

Table10: Type of Shot and Probability of Goal (Japan)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	16	41.0	2	25.0	12.5
Floater	0	0	0	0	0
Cut-in	0	0	0	0	0
Other	1	2.6	1	12.5	100.0
Counter	5	12.8	2	25.0	40.0
Wet shot	9	23.1	2	25.0	22.2
Penalty	1	2.6	1	12.5	100.0
Total	32	100	8	100	20.5

Table11: Brazil's Position at the Time of Japan's Middle Shot and the Result

Quoter		Defensive formation	Outcome	Scored
1	1	Zone D	D Rebound	X
1	2	Zone D	Out	X
1	3	Zone D	BP Rebound	X
2	4	Zone D	Corner	X
2	5	Zone D	BP Rebound	X

2	6	Zone D	D Rebound	X
3	7	Press D	BP Rebound	X
3	8	Press D	Out	X
3	9	Zone D	Goal	○
3	10	Press D	Keeper	X
3	11	Zone D	Corner	X
3	12	Zone D	Goal	○
3	13	Other	Out	X
4	14	Zone D	Keeper	X
4	15	Zone D	K Rebound	X
4	16	Zone D	Keeper	X

（２）Brazil's Offense

<Characteristics of Brazil's Offense Skill>

As Table 12 shows, Brazil's offense was diverse, with twenty-two shots, far fewer than Japan's. In order of frequency, floaters accounted for five shots, 23% of the total, with three successful goals, with a high success rate of 60%. The second most common type was the mid-range, with four shots, 18% of the total, and one successful goal, which was 25% of the total. The same number of outside water shots were taken, with three successful, indicating an extremely high success rate of 75%. Three counter shots were taken with 100% success rate, and the penalty rate was also high at 67%. Except for the midfield, all types of shots had an accuracy rate above 50%, with sixteen successful out of twenty-two shots.

Brazil took fewer shots but dominated Japan with an extremely high 73% success rate. The Japanese defense was at the mercy of this variety of shots.

＜The Reason for the Increase in the Success Rate of Floater Shots in Brazil＞

As shown in Table 13, most of the shots were made when Japan used the line defense technique, which means that the passes were made from an elevated position, and Japanese players, who are shorter on average in height, could not intercept the passes, and the ball was easily passed to the floater. As this attacking style was repeated, the inability of the defense to break it down led to a large loss of points.

Table 12: Type of Shot and Probability of Goal (Brazil)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	4	18.1	1	6.3	25.0
Floater	5	22.7	3	18.8	60.0
Cut-in	1	4.5	1	6.3	100.0
Other	2	9.1	2	12.5	100.0
Counter	3	13.6	3	18.8	100.0
Wet shot	4	18.1	3	18.8	75.0
Penalty	3	13.6	2	12.5	66.6
Total	22	100	16	100.0	72.7

Table13: Japan's Position at the Time of Brazil's Floater Shot and the Result

Quoter		Defensive formation	Outcome	
1	1	Line D	Out	X
1	2	Line D	Goal	○
1	3	Line D	Goal	○
3	4	Press D	Goal	○
4		Line D	Goal	○

3) Japan vs. Australia [6-8] Defeat

（1）Japan's Offense

<Characteristics of Japan's Offense Against Australia>

As shown in Table 14, Japan's goal scoring rate was 26%, almost the same as that of Greece. However, the counterattack, which is Japan's forte, caused Japan to struggle with three shots and no goals. Mid-range shots accounted for 48% of all shots, about half of the total, but the success rate was low at 18%.

<Why Japan's Counter Shots were Well Defended by Australia>

As Table 15 shows, counters can usually only be defended with other Ds, but the opposing country tried to defend using Press defense or zone defense, indicating that the counter style was not perfect.

Table 14: Type of Shot and Probability of Goal (Japan)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	11	47.8	2	33.3	18.1
Floater	0	0	0	0	0
Cut-in	2	8.7	2	33.3	100.0
Other	2	8.7	0	0	0
Counter	3	13.0	0	0	0
Wet shot	5	21.7	2	33.3	40.0
Penalty	0	0	0	0	0
Total	23	100	6	100.0	26.1

Table:15 Australia's Position at the Time of Japan's Counter and the Result

Quoter		Defensive formation	Outcome	Scored
2	1	Press D	K Rebound	X
2	2	Press D	Keeper	X
3	3	Zone D	BP Rebound	X

（2）Australia Offense

<How did Japan Hold Off Australia's floater Shot?>

As shown in Table 16, the Australian side took the most shots with ten floater shots, accounting for 40% of the total twenty-five shots. However, the goal scoring rate was low at two shots, or 20%. The next highest number of shots was from outside water, with five shots, accounting for 32% of all shots, and four goals, for a success rate of 50%. It can be said that the attackers made full use of their numerical advantage. Their outside water techniques had a significant impact on the game. There were only two Cut-in shots, but the decision rate was 100%.

<How did Japan Hold Off Australia's Floater Shots?>

As Table 17 shows, similar to previous games, many of the shots were easy for the

goalkeepers to stop.　Pass Line Defense proved effected against Australia.

Table16: Type of Shot and Probability of Goal (Australia)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	2	8.0	0	0	0
Floater	10	40.0	2	25.0	20.0
Cut-in	2	8.0	1	12.5	50.0
Other	1	4.0	1	12.5	100.0
Counter	2	8.0	0	0	0
Wet shot	8	32.0	4	50.0	40.0
Penalty	0	0	0	0	0
Total	25	100	8	100.0	32.0

Table17: Japan's Position at the Time of Australia's Floater Shot and the Result

Quoter		Defensive formation	Outcome	
1	1	Line D	Corner	X
1	2	Line D	Goal	○
1	3	Line D	Corner	×
1	4	Press D	Keeper	×
2	5	Line D	Keeper	×
2	6	Line D	Keeper	×
2	7	Press D	Out	×
2	8	Line D	Keeper	×
4	9	Press D	Goal	○
4	10	Line D	K Rebound	×

4）Japan vs. Hungary [7-18] Defeat

（1）Japan’s Offense

<Characteristics of Japan's Offense Against Hungary>

As Table 18 shows, of Japan's 26 shots, the most were midrange shots with eight shots taken, accounting for 30.8% of all attempts. However, not a single goal was scored.　Next were outside water shots, also with eight shots.　Three of these shots were successful, for an accuracy of 38%.　The next most common type of shot was the counter shot with five shots, three of which resulted in goals.　The success rate was as high as 60%, and it can be said that Japan's signature counterattacks were effective. However, because Japan was unable to use a variety of attacks, such as mid-range and cut ins, and instead focused on narrowing down the attack, the game became monotonous and easy to read.

＜Why were Japan's mid-range shots unsuccessful?＞

As shown in Table 19, all the shots were rejected by the keepers and defenders, indicating that many of the midrange shots that Japan took were their only option.

Table 18: Type of Shot and Probability of Goal (Japan)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	8	30.8	0	0	0
Floater	1	3.8	0	0	0
Cut-in	1	3.8	0	0	0
Other	2	7.7	0	0	0
Counter	5	19.2	3	42.9	60.0

Wet shot	8	30.8	3	42.9	37.5
Penalty	1	3.8	1	14.3	100.0
Total	26	100.0	7	100.0	26.9

Table19: The Hungarian Team and the Result of Japan's Middle Shot

Quoter		Defensive formation	Outcome	
1	1	Press D	Keeper	×
1	2	Press D	Corner	×
1	3	Press D	Keeper	×
2	4	Press D	D Rebound	×
3	5	Press D	K Rebound	×
3	6	Zone D	BP Rebound	×
4	7	Zone D	Corner	×
4	8	Zone D	Keeper	×

（2）Hungary's Offense

<Characteristics of Hungary's Offense >

As Table 20 shows, Hungary, like Brazil, has a wide range of attacks and a high success rate. The most common type of shot was the counter, with nine shots, five of which were goals, resulting in a high decision rate of 55.6%. Both Japan and Hungary scored many goals on the counter. The next most common shots were mid-range and floaters, with five floaters scoring goals. The success rate was remarkably high at 71.4%, which contrarily indicates that the Japanese defense was insufficient. Hungary's scored seventeen out of thirty-four shots with a high scoring rate of 50%. Hungary also had two outside water shots and one penalty, both at 100% success rate, but in comparison to other teams, they had very few shot opportunities related to penalties.

<Why couldn't Japan Hold Off the Hungarian Counter?>

As Table 21 shows, Japan seemed to have concentrated too much on the attack in this match, and failed to defend against Hungary, even though Japan was said to be as good as Hungary in swimming ability. Japan focused on attacking on the counter, and other defensive strategies may have been insufficient or did not work.

Table20: Type of Shot and Probability of Goal (Hungary)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	7	20.6	1	5.9	14.3
Floater	7	20.6	5	29.4	71.4
Cut-in	6	17.6	2	11.8	33.3
Other	2	5.9	1	5.9	50.0
Counter	9	26.5	5	29.4	55.6
Wet shot	2	5.9	2	11.8	100.0
Penalty	1	2.9	1	5.8	100.0
Total	34	100.0	17	100.0	50.0

Table21: Japan's Position at the Time of Hungary's Counter and the Result

Quoter		Defensive formation	Outcome	
1	1	Other D	Goal	○
1	2	Other D	Goal	○
2	3	Other D	Goal	○
2	4	Other D	Out	×
2	5	Other D	Goal	○
3	6	Other D	Goal	○
3	7	Press D	Out	×
4	8	Press D	Goal」	○

5）Japan vs. Serbia [8-12] Defeat

（1）Japan's Offense

<Characteristics of Japan's Offense Against Serbia>

As shown in Table 22, the most common of Japan's 32 attempted shots was fifteen middle shots, accounting for 47%, however no goals were scored. The next most common was outside water shots which accounted for seven shots, including two shots on goal, with a success rate of 28.6%. The third was Japan's strong point, the counter, with three shots, two of which were goals, with a success rate of 66.6%. Japan took thirty-two shots, which was not a small number. The total number of mid-range and outside water shots was twenty-two, but both types were held back by the Serbian defense and only two of them were scored.

<Why were Japan's Mid-Range Shots Unsuccessful?>

As Table 23 shows, in the Serbia match as well as in the Hungary match, all shots were rejected, indicating that many of their shots were taken as their sole option at the time, and 100% of them were suppressed by Serbia's Press defense.

Table 22: Shooting Types and Goal Probability (Japan)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	15	46.9	0	0	0
Floater	1	3.1	0	0	0
Cut-in	2	6.3	1	12.5	50.0
Other	2	6.3	1	12.5	50.0
Counter	3	9.4	2	25.0	66.6
Wet shot	7	21.9	2	25.0	28.6
Penalty	2	6.3	2	25.0	100.0
Total	32	100.0	8	100.0	25.0

Table23: Japan's Middle - Serbia's Position at the Time of the Shot and the Result

Quoter		Defensive formation	Outcome	
1	1	Press D	Keeper	×
1	2	Press D	Keeper Rebound	×
2	3	Press D	Out	×
2	4	Press D	BP Rebound	×
2	5	Press D	Defense	×
3	6	Press D	Keeper	×
3	7	Press D	Defense	×
3	8	Press D	Keeper	×
4	9	Press D	D Rebound	×
4	10	Press D	BP Rebound	×
4	11	Press D	D Rebound	×
4	12	Press D	D Rebound	×
4	13	Press D	BP Rebound	×
4	14	Press D	Keeper	×
4	15	Press D	D Rebound	×

（2）Serbia Offense

<Characteristics of Serbia's Offense>

As Table 24 shows, the Serbian offense took thirty shots, with the most shots coming from Cut-ins (13 shots, 43%), including four shots on goal (31%). The

second most common type of shot was outside water with seven, including three on goal, accounting for 43%. Characteristically, there were no midrange shots, which was the most common for Japan.

<How Japan Prevented Cut-ins from Serbia>

As can be seen in Table 25, line defense seems to have been effective for Serbia, as Japan was able to hold off most of Serbia's Cut-ins with line defense.

Table24: Type of Shot and Probability of Goal (Serbia)

Shooting Style	Number of shots	Percentage of total shootings%	Scored Goal	Ratio of Scored Goal %	Shooting Rate %
Middle	0	0	0	0	0
Floater	2	6.7	0	0	0
Cut-in	13	43.3	4	33.3	30.8
Other	5	16.7	2	16.7	40.0
Counter	1	3.3	1	8.3	100.0
Wet shot	7	23.3	3	25.0	42.9
Penalty	2	6.7	2	16.7	100.0
Total	30	100.0	12	100.0	40.0

Table25: Key Points and Results of the Japanese Team at the Time of Serbia's Cut-in

Quoter		Defensive formation	Outcome	
1	1	Line D	BP Rebound	×
1	2	Line D	Keeper	×
1	3	Line D	Out	×
2	4	Press D	Keeper	×
2	5	Line D	Keeper	×
2	6	Other D	Goal	○
2	7	Line D	Goal	Foul
2	8	Zone D	Goal	○
3	9	Line D	Goal	○
3	10	Line D	Out	×
3	11	Line D	Keeper	×
3	12	Line D	Keeper	×
4	13	Line D	Goal	○
4	14	Line D	Keeper	×

5-2 Comparative analysis by shooting pattern for each country

Next, I further subdivided the data by shoot, made graphs, and analyzed them to compare the differences between Japan and other countries. These graphs were written on graph paper and then attached to a PDF file, resized and edited. (The actual size of the graphs is attached in the appendix)

1) Japan vs. Greece Shoot-by-Shoot Analysis

The results of the match against Greece were as shown in Figure 8. First of all, the goal percentage of middle shots was 10% for Japan and 100% for Greece, and Japan missed 9 times while Greece missed 0 times. This suggests that the quality of Japan's middle shots is inferior. Moreover, the number 9 is the highest in this graph. Next is the floater position, which is the center position in water polo. Japan had only one chance to hit a floater and missed it. Greece, on the other hand, hit it seven times. However, the defense and the keeper kept them to one goal. Japan had only one floater shot, probably due to the height difference between Japan and Greece. The Cut-ins are evenly split with Greece at two-fourths, but Japan's numbers are low both in terms of the number of Cut-ins and the conversion rate. The Cut-in movement is very tiring, so it is likely that Japanese players did not do it. The counter is a shot that must be taken. However, Greece successfully made 100% of their counter shots (although, the Greek players are not amazingly fast swimmers, so they made only one counter shot), while Japan made six shots, but only three went in, indicating a certain lack of precision. At the time of retreat, both teams were not able to score any points. In most cases, the penalty shooter (Takei) has a 100% conversion rate, but the rate here was 50%. However, in the other games that I will show later, the decision rate was 100%, so either the quality of the keeper or Takei's concentration was the cause. (The "Other" column is too large to analyze, so we will just show it as one piece of information.

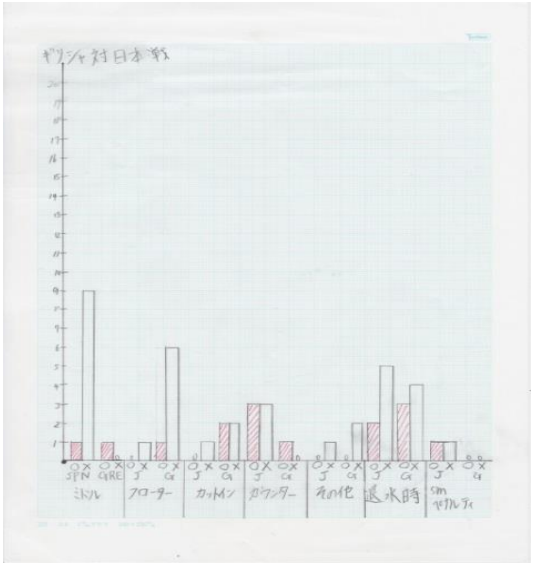


Fig8; Japan vs Greece Analysis Graph by Shoot

2) Shoot-by-Shoot Analysis of Japan vs Brazil

The match against Brazil was as shown in Figure 9 below. The trend is the same as in the Greece game. However, it can be clearly seen that Japan missed significantly more mid-range shots than Greece. In addition, the number of shots that Japan missed when retreating from the water was the second largest, so Japan should take the initiative in retreating from the water set (a practice method for when retreating from the water) and should practice counters as well. Brazil's floater shots are brilliant, taking advantage of their height. In addition, they have been making 100% of their counter shots, which shows the difference between Brazil and Japan.

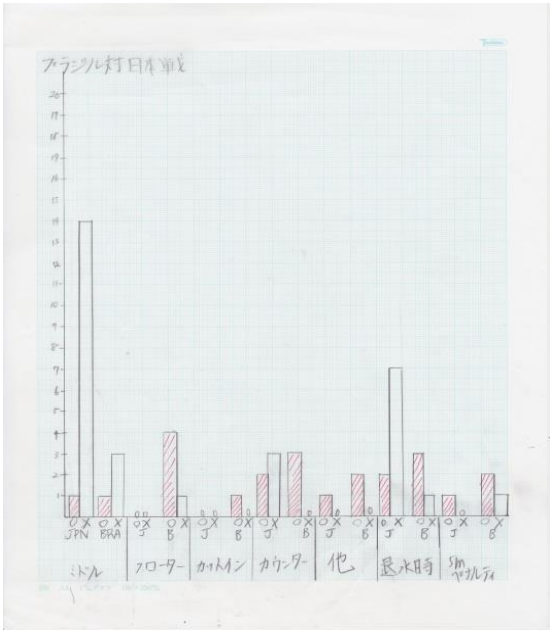


Fig9; Japan vs. Brazil Analysis Graph by Shot

3) Shoot-by-Shoot Analysis of Japan vs Australia

In the match against Australia, the results are shown in Figure 10 below. The trend is almost the same, except that the number of missed shots when exiting the water is high for both Australia and Japan, and the counter shots are not converted well. (I use the word "almost" because the number of shots taken is different.)

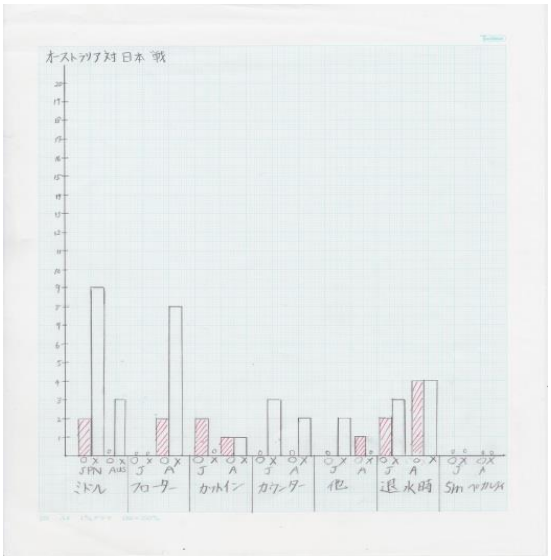


Fig.10 Japan vs Australia Analysis Graph by Shot

4) Shoot-by-Shoot Analysis of Japan vs Hungary

The match against Hungary turned out as shown in Figure 11 below. Japan's shooting tends to be almost the same as in the previous games, but Hungary has been doing a lot more counter shooting than the other teams (and thus missing a lot more

times) and has been making 100% of their shots when leaving the water. Incidentally, it is said that it is surprisingly difficult to take a shot when leaving the water, even though you have a numerical advantage. Therefore, it can be said that they have an elevated level of skill to make 100% of their shots when leaving the water.

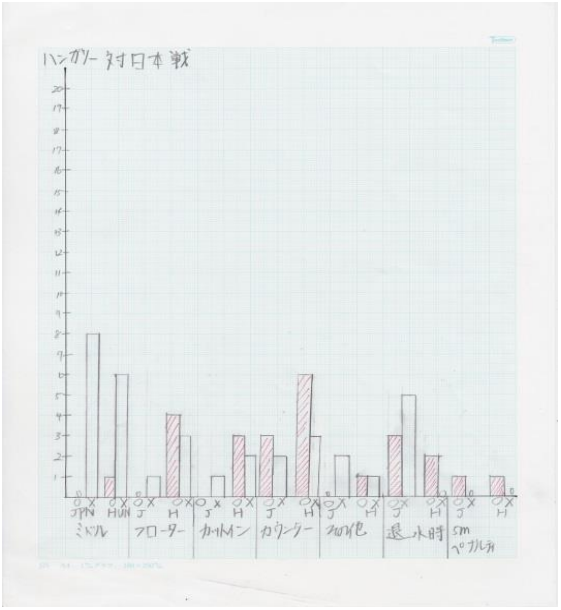


Fig.11 Japan vs Hungary Analysis Graph by Shoot

5) Shoot-by-Shoot analysis of Japan vs Serbia

As Figure 12 below shows, Japan misses all of its mid shots, even though it takes many of them (this number was the highest of all the numbers in this graph). (This number is the highest in this graph.) They also missed many shots when leaving the water. Serbia also had the highest number of shots (Cut-ins only) in the entire match. It seems that they were overly aggressive in their Cut-ins. However, since they had to get away from the defense to get the ball and shoot, they had to shoot quickly or the defense would catch up with them, which made their shots less accurate and less likely to go in. That is why the result was 4/14 times.

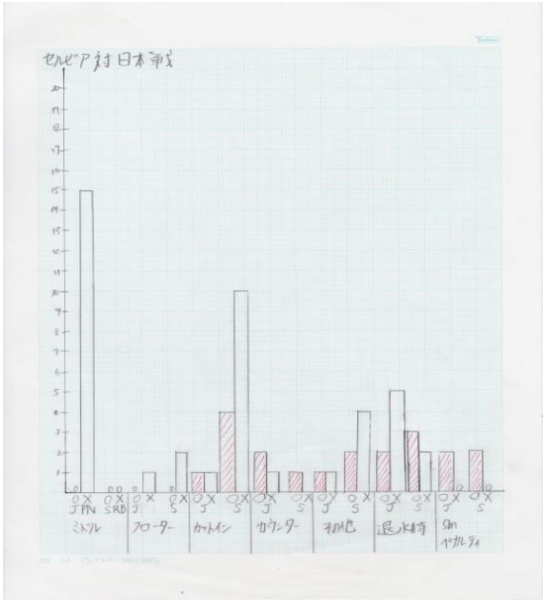


Fig.12 Japan vs Serbia Analysis Graph by Shoot

6) Out-of-water shooting pattern analysis for each country

As mentioned earlier, when the water retreats, there are fewer people on the defensive side, so it is easier to attack. In this section, the tendency of shooting at the time of retreat was graphed and analyzed.

This was done with one point per ten squares.

(1) Japan vs. Greece

As Figure 13 shows, the diagram is almost flat, so it is hard to tell the difference, but if you look closely, you can see that Japan has not included the right side (Kakuno and Shiga's positions) and the left side (Takei, Adachi or Arai), as well as the right and left posts (Iida, Yasuda, Shimizu, Yanase) at all. That is why the points are concentrated on the top left and right. However, it does not mean that they did not shoot at all, so this is either a lack of determination or impatience with the decrease in time in the water due to too much passing. In Greece, the top right, right side, and left side were not getting in. The number of times the left side missed was particularly noticeable. However, the rest of their shots were either 100% or 50%, so it cannot be said that their decision rate is that low. Incidentally, Japan's decision-making rate when leaving the water was 28.5%, while Greece's rate was 42.8%. There is a point that both sides are not playing from the right side.

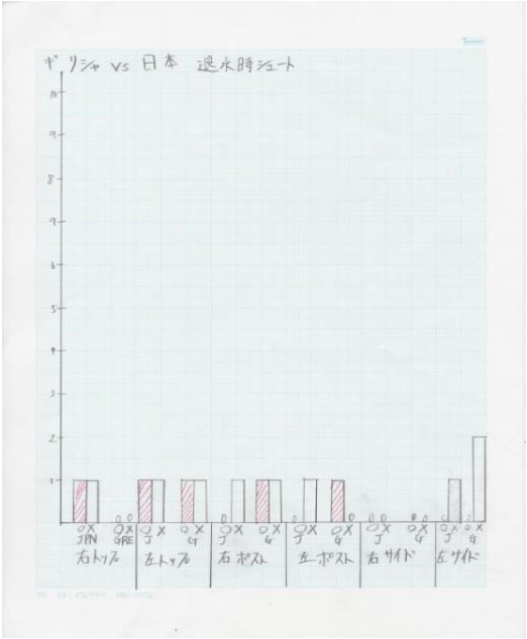


Fig13. Japan vs. Greece Shootout at Water Retreat

(2) Japan vs. Brazil

As Figure 14 shows, the pattern is similar to the one against Greece, except that Japan does not have a single shot on the left side, which is almost the same trend. For Japan, the shots on the left side are starting to go in. This is probably because in the second game, they did not pass the ball around so much when exiting the water, so the Japanese players became less impatient and were able to shoot calmly. The rest of the results show that both teams are the same when it comes to shooting. The decision rate was 22.2% for Japan and 75% for Brazil. It can be seen that Brazil's scoring decision rate is extremely high.

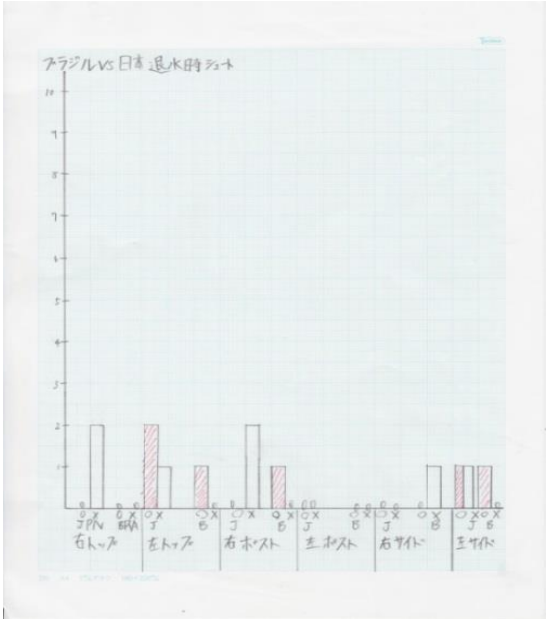


Fig.14:　Shots during Water Retreat in Japan vs. Brazil

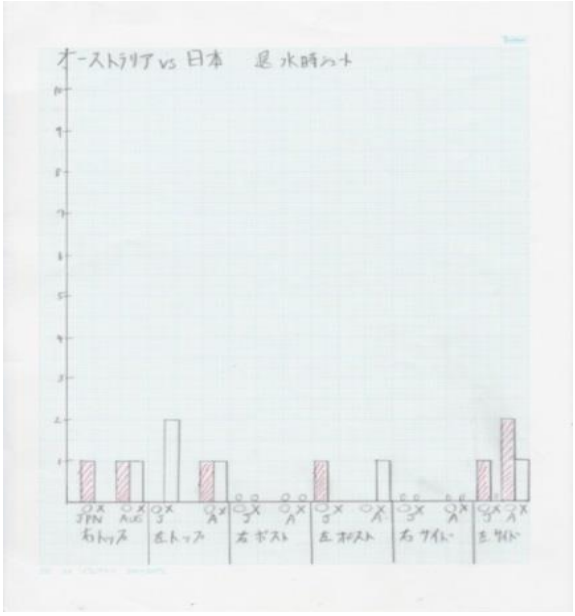


Fig 15:　Japan vs Australia Shoot Out at Water Retreat

(3) Japan vs. Australia

As Figure 15 shows, there are more positions that tend to be about the same but never shoot. The decision rate is 40% for Japan and 50% for Australia.　Both are quite high, and Japan's has risen considerably.

(4) Japan vs. Hungary

As Figure 16 shows, Japan seems to have missed a few too many times. However, the left side and the top right side had a 100% decision rate, which is quite high.　For Hungary, the overall decision rate was exceedingly high, at 100%.　As I mentioned earlier, this is a great achievement.　Incidentally, Japan's decision rate was 37.5%.

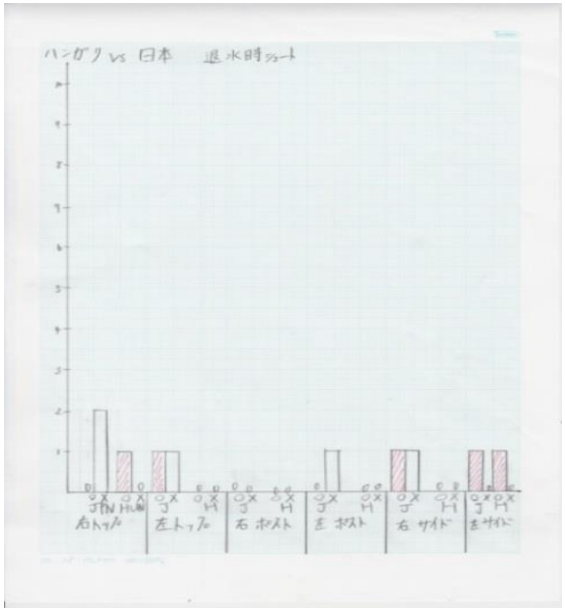


Fig.16 Japan vs. Hungary Shootout at Water Retreat

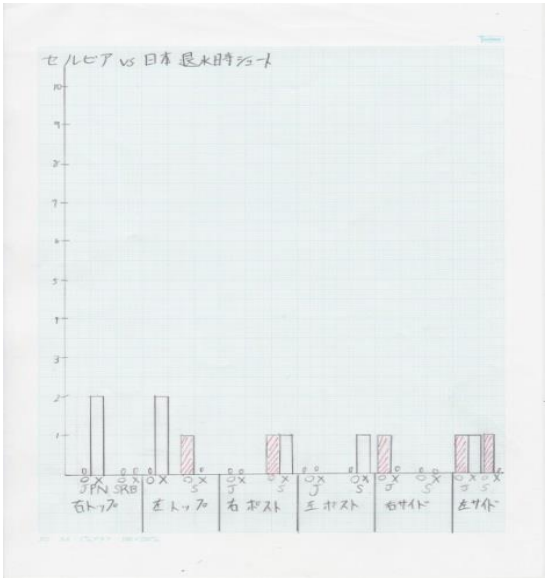


Fig.17 Japan vs. Serbia: Shots at Water Retreat

(5) Japan vs Serbia

As Figure 17 shows, Japan produces similar results in this match. Japan's decision rate is 28.5%, while Serbia's is 60%. As you can see from the graph, it is easy to see that Japan missed many times.

5-3 Analysis of goal positioning

Next, based on the records of shot positioning, we analyzed the trends of home and enemy countries to see where they shoot from most often and where their shots lead to scoring decisions.

To record, as shown in the diagram below, if the Japanese team shot first from the place ① (in front of the goal), ① was written in the positioning of square A3. If the shot went in, the circle was filled in with red. All shots were numbered consecutively and recorded in conjunction with the sheet for overall analysis.
(However in this paper, I decided to mark just circle without numbers) If the shot either missed or blocked by goal keeper, then I marked with cross (✕).

	5	4	3	2	1
A			①		
B					
C					
D					
E					
F					

Fig.18: Goal positioning table

1) Japan vs. Greece

Japan's positioning of shots (Table 26-1) shows that they are scattered but concentrated on middle and floater shots in the three positions. This can be attributed to Cut-ins by the Press -defense and heavy blocking by the defense. In addition, due to the 30-second time limit of the attack, the pattern of mid shots and floater shots, which have a low chance of going in, is thought to have become a consistent pattern. In water polo, not only for Japan's national team, but there is also a pattern of sending the ball to floaters when the attack is at a standstill. Also, as I mentioned earlier, we can see that they have missed the top shots on both sides due to their impatience when leaving the water. On the other hand, Greece's powerful 3A floater shot, which makes the best use of their height and size, is particularly good, and they made 2 out of 5 shots. They also had two out of six shots from the 3B floater back. He also scored two out of two balls from 2B. It is highly possible that Japan's defense on the right side tended to be too weak (Table 26-2).

Table 26-1: Positioning of Japan

	5	4	3 Goal	2	1
A		○×	×××	○	
B		××	×××	××××	
C		○×	○○○××	○×××	×
D			×××××		
E					
F					

Table 26-2: Positioning of Greece

	5	4	3 Goal	2	1
A			○○×××		
B		××	○○××× ×	○○	
C			○○××× ××		
D					
E					
F					

2) Japan vs. Brazil

Brazil's shooting was mostly concentrated in the A and B zones, and they were mostly successful. Brazil's shooting was mostly concentrated in the A and B zones, and they were almost always successful. 3A floater shots were also

common, as in Greece. This shows that Japan's challenge is to defend against floaters once the ball is passed to them. In contrast to Greece, all shots from the left were scored against Brazil, indicating that Japan's defense on the left was weak. (Table 27-1, 2)

Table27-1: Positioning of Japan

	5	4	3 Goal	2	1
A		○	×		
B		××××××	○××××	○××	
C			○○○×× ×××		
D			○○×		
E					
F			×		

Table27-2: Brazil's Positioning

	5	4	3 Goal	2	1
A		○	○○○○	○×	
B		○○○	○○○○○ ××	○×	
C			○×	○×	
D					
E					
F			×		

3) Japan vs Australia

Japan shoots with more evenly scattered positions than in the previous two games, but also with more 3D. Also, the lack of shots with positioning at 3B indicates that the ball is not going around the floater (Table 28-1). On the other hand, Australia's positioning is concentrated on 4B and 3B, and most of their shots are floaters. The match highlighted the issue of defending in front of the goal (Table 28-2).

Table28-1; Positioning of Japan

	5	4	3 Goal	2	1
A	○		○		
B		○×××|		○ ○	
C		×××	×××××		
D		××	○××××		
E					
F					

Table28-2: Australia's Positioning

	5	4	3 Goal	2	1
A			××		
B		○○○○× ××××	○○○○×× ×××××		
C					
D					
E					
F				×	

4)Japan vs. Hungary

As in the other games, the Japanese attacked with B and C positioning, with 5, 4, 3, and 2 also scattered to the left and right. The difference between this game and the other games is that the decision rate in the three position is higher (Table 29-1). Like other teams, Hungary also scored many goals by floater positions, but the difference between Hungary and other teams was that the positioning was not constant but scattered (Table 29-2).

Table 29-1 Positioning of Japan

	5	4	3 Goal	2	1
A			○×		
B	×	○×	○○×	○×××	
C	×	×××	○○××××	×××	
D			○××××	×	
E					
F					

Table29-2 Positioning of Hungary

	5	4	3 Goal	2	1
A		×	○○○○		
B	×	○○○○○×	○○×××××	×	
C		×	○○○○××××××	○××	
D					
E					
F		×			

5) Japan vs Serbia

The difference between Japan and the other games is that Japan is attacking and scoring from the A-positioning and has not taken a single shot from the 3B-position, which has been coming in attack so far. In short, the floaters are not passing the ball around (Table 30-1). Serbia shot mostly from the 4B, 4C, 3B, 3C, 2B, and 2C positions in front of them, and they were well-balanced and scattered in that range. In addition, we can see that Japan is able to defend the left positions of 4 and 5 in this game (Table 30-2).

Table 30-1 Positioning of Japan

	5	4	3 Goal	2	1
A		×	×	○	○
B	○	○××		○×	
C		○×	○○××× ××××	××	
D		×		×	
E		××			
F			×		

Table 30-2 Positioning of Serbia

	5	4	3 Goal	2	1
A	×	○×	○○××××	○○×	
B		××××	○○○×× ××	○○××	
C		××	○○××		
D					
E					
F			×		

6) Trends in shooting positions across all games

Throughout all the matches, the opposing countries have a high decision rate in floater shots, while Japan shows that it does not compete in floater shots. In addition, except for Japan and Brazil, they are biased toward floater shots or middle shots and shots from either the left or right position. For example, Australia in Table 28-2 is weighted toward the middle and left, and Hungary in Table 29-2 is also weighted toward the middle and left. In Japan and Brazil, shooting positions are "scattered" instead of repeating the same place. This means that it is difficult for the keeper to predict where the ball will be shot. Teams that score in uneven shooting positions probably have their ace strikers shoot in positions where the ball is more likely to go to the ace striker and where the ace striker has a higher chance of scoring.

5-3 Shoot course analysis

Figure 19 was created by adding the armpit to the division method of Masaaki Su (2007). This was added because there were many cases in actual games where players scored by bouncing the ball against the keeper's body or head and daringly aiming at the armpit of the keeper, instead of taking a course to avoid the keeper.

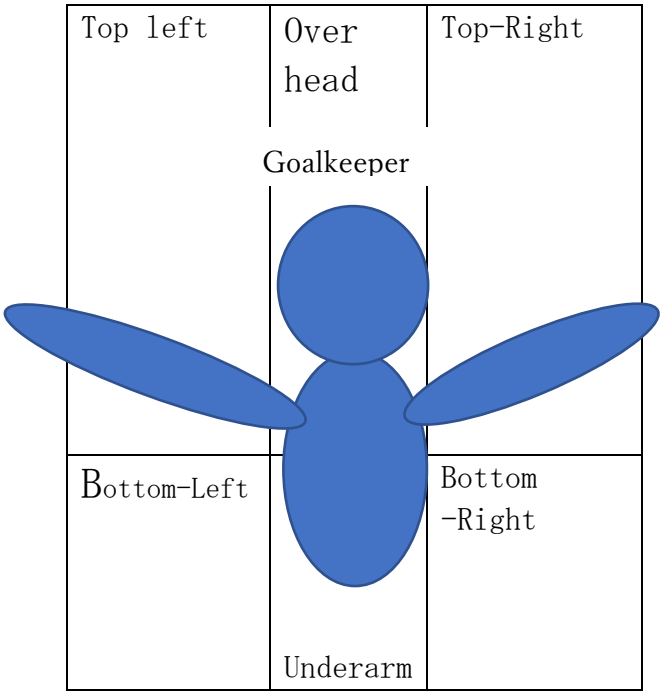


Fig19: Shooting Course Classification Table

1) Japan vs. Greece

Japan is concentrating on the left and right bottom. The tendency in Japan's game is that Japan has a lot of bounce shots. This may be the reason for the high percentage of shots that are aimed at the lower left or lower right. Greece has a similar style, but compared to Japan, they also shoot in the upper right and lower right. This may be due to the difference in the reach of the keeper's height.

Table 31-1 Japan vs Greece (Japan side)

Top-Left	Overhead	Top-Right
	○	
Bottom-Left ○○○○	Underarm	Bottom-Right ○○

Table 31-2 Japan vs Greece (Greece side)

Top-Left	Overhead	Top-Right
○		○
Bottom-Left ○○○	Underarm	Bottom-Right ○○○

2) Japan vs. Brazil

Japan scored against Brazil not only underneath, but also above the head and on the left, as they did against Greece. Brazil scored on almost any course, so it is possible that the Japanese defensive strategy was not effective in the Brazil match.

Table 32-1 Japan vs Brazil (Japan side)

Top-Left	Overhead	Top-Right
○○	○○	
Bottom-Left	Underarm	Bottom-Right
○○		○○

Table32-2 Japan vs Brazil (Brazil side)

Top-Left	Overhead	Top-Right
○	○○○	○○
Bottom-Left	Underarm	Bottom-Right
○○○ ○○○	○○○	○

3) Japan vs Australia

In this game, Japan has scored on the left side both top and bottom. Australia has won all but the top right corner. The lower left side was attacked intensively and was decided.

Table 33-1Japan vs Australia (Japan side)

Top-Left	Overhead	Top-Right
○○		○
Bottom-Left	Underarm	Bottom-Right
○○	○	

Table 33-2 Japan vs Austria (Australia side)

Top-Left	Overhead	Top-Right
○	○○	
Bottom-Left	Underarm	Bottom-Right
○○○ ○	○	○

4) Japan vs Hungary

Japan did not have many shots in the game, but they scored three goals in the top left corner. Hungary, like Brazil, scored in every position.

Table 34-1 Japan vs Hungary (Japan side)

Top-Left	Overhead	Top-Right
○○○	○	○
Bottom-Left	Underarm	Bottom-Right
○	○	

Table 34-2 Japan vs Hungary (Hungary side)

Top-Left	Overhead	Top-Right
○○	○○○○	○
Bottom-Left	Underarm	Bottom-Right
○○○○	○○○○	○○

5) Japan vs Serbia

For the first time, Japan scores on all courses. Serbia has scored on almost every course, but none in the armpit. Japan's shooting style has always been similar to Serbia's, but against Serbia, the game was different. In fact, they succeeded in scoring in all the different courses, which suggests that they may have used a different strategy from the previous four games, or that they may have reflected on their experience in the last game.

Table 35-1 Japan vs Serbia (Japan side)

Top-Left	Overhead	Top-Right
○	○○	○
Bottom-Left	Underarm	Bottom-Right
○○	○	○

Table 35-2 Japan vs Serbia (Serbia side)

Top-Left	Overhead	Top-Right
○	○○	○○○○
Bottom-Left	Underarm	Bottom-Right
○○○		○○

6) Tendency of Shooting Courses Throughout the Entire Game

In the first half of the match, Japan's shooting courses tended to be unbalanced, and it is highly possible that the opposing country was able to read their courses. In fact, Japan lost the game against Serbia, but it is worth noting that Japan scored on every shot course. Also, in games that were close, the opposing team did not score on all of Japan's shots, but in games where the score gap was wide, such as Brazil and Hungary, the shots were scored on all the courses. This can be attributed to the fact that the opposing team, fearing the loss of a single goal due to the close game, defended in a variety of positions. On the other hand, the team with the largest margin of victory had three or more shots in the same positions: lower left, under the armpit, and above the head, suggesting that they found the weakness of the Japanese goalkeeper early and deliberately targeted it.

5-4 Summary of analysis results and discussion

To sum up the results of the analysis, Japan's passing line defense was effective to a certain extent in the Asian qualifiers and aided in qualifying for the Olympics, but it was still difficult to score enough points to win the games using that strategy alone when opposing physically larger Brazilian or Australian players, for example, in which cases Japan lost by a large margin. However, against countries such as Greece and Serbia, who are playing based on the old water polo strategy, the passing line defense attack showed its usefulness. For example, against Greece, they scored a high percentage of their goals on the counter. They also held off a large number of Serbia's Cut-ins. In addition, many of Hungary's and Brazil's middle shots and Australia's floater shots were suppressed. If we can thoroughly suppress the shots that each country is good at (for example, Hungary's counter shots, Brazil's floater shots, etc.), the passing line defense will be more effective.

However, there were many challenges. Japan's strategy was to take advantage of their swimming ability and use pass-cuts to counter. However, there were times when these counters were completely blocked by the opponent. When this happened, the Japanese players tended to be reluctant to counter. In addition, Japan had more shots than their opponents in almost every game, which means that they had more opportunities to attack. However, the remarkably low scoring rate, especially in the first half of the match, may have been due to the fact that Japan's shooting positions were similar to those of their opponents, making it easier for them to read them. Although it is not easy, shooting accuracy is also something that needs to be improved. In addition, while other countries have a high percentage of floater shots that decide the score, Japan has far fewer floater shots. The height difference may make it difficult for floaters to get the ball in front of the goal, but this is another area for improvement.

Overall, the games against Greece and Serbia were typical of Japan's national team. As Tada mentioned earlier, water polo requires more physical and mental toughness than any other sport in an unsupportive and difficult-to-control environment and considering that Greece's match was the first and Serbia's was the last, mental factors such as enthusiasm for a win in the first match and hope for a win in the last match may have played a role. In other words, there is evidence suggesting that it may have been a psychological factor.

"The best instructors memorize almost all the shooting information of their

opponents in a game and organize it in their minds as necessary to determine tactics to advance the game, closely resembling Shogi and Go players memorizing all the game records in their matches, " said Enomoto et al. In reality, however, it is extremely difficult to memorize information about the flow of the game and the shots, and they often rely on their fragmentary memories to form an impression of the game and the characteristics of the opposing team's shots. Therefore, in order to reflect on the game based on the shooting tendencies of the opposing team, and to ensure that there is a collective understanding of the issues and challenges, it is necessary to collect all the information on shooting and analyze the tendencies objectively. In water polo, the information stored is more limited than in athletics on land, because the water often blocks the view. Because of the time spent submerged in the water, it is difficult to grasp the whole picture, and therefore, more than any other sport, it is necessary to look back with objective analysis. In fact, in 1997, the research department of the Water Polo Committee of the Japan Swimming Federation developed a system to analyze the shootings for the purpose of popularizing water polo in Japan, and this system was used to analyze the shootings at the Kyoto Athletic Meet in the same year. The results analyzed by this system were output within 20 minutes to an hour after the game and distributed not only to the players and coaches but also to the spectators (Takahashi et al. 1997). In the future, for the further popularization of water polo and for the strengthening of Japanese water polo players, it is hoped that such an analysis system can be normalized and that a method for objective analysis of shots can be developed.

6. Conclusion

On August 24, 2016, I was fortunate enough to have Tomonori Kadono, a member of the Japanese 2016 Rio de Janeiro Olympics water polo team, visit our school's club team and give us direct instruction. The strength of an Olympian's passes was beyond my imagination.

With Japan's men's national water polo team qualifying for the Olympics for the first time in 32 years, water polo is becoming more popular. As proof of this, when I was in elementary school, I was often asked, "What are you?", and I answered, "Suikyu (water polo)," and their reactions were always the same, "What? Suigyu (a water a buffalo)? What kind of sports is that?" But now, when I tell people that I am a member of the water polo club, I get a certain response: "Oh, that underwater fighting sport."

However, not much is known about what kind of sport it is. There are few televised water polo matches, and few books and research papers on the sport. It is rarely introduced in physical education classes at schools. I believe that the reason water polo has remained a minor sport in Japan is not only because of the distance from the Olympics, but also because of these factors.

Through researching for this paper, I learned that water polo is not only a game of swimming ability and strength, but also a game of underwater offensive and defensive strategies, the excitement of predicting and strategizing much like in a game of chess, and the various possibilities of analyzing the game from multiple perspectives. Although Japan lost in the qualifying round at the Rio de Janeiro Olympics, its unique water polo system, called pass line defense, showed a certain level of success against strong opponents, and has the potential to develop in the future.

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