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Meta-Analysis of the Bacterial Detection Rate in Perianal Abscess

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Abstract: Literatures on the distribution of bacteria in perianal abscess from different regions and at different times were systematically analyzed, and the distribution of pathogens in perianal abscess was meta-analyzed using STATA 12.0 statistical software. The results showed that the detection rate of Escherichia coli was 0.64 (95% CI, 0.54-0.74), Klebsiella pneumoniae was 0.13 (95% CI, 0.12-0.15), and Staphylococcus was 0.07 (95% CI, 0.04-0.10).

Keywords: Perianal abscess; Meta-analysis; Bacteria; Flora; Escherichia coli; Klebsiella pneumoniae; Staphylococcus; Antibiotic

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1. Introduction

Perianal abscess is the abbreviation of perianorectal abscess. It is characterized by an acute and rapid onset. In physiological anatomy, it is an acute suppurative infection dominated by the space around the anal canal and rectum. Pain, swelling, and fever are considered to be the clinical manifestations of perianal abscess. As early as 1961, A.G. Parks, the Consultant Surgeon of London Hospital, introduced the hidden gland theory. Infection penetrates the anal wall through cracks or other wounds. Once the trace of infection is established, it enters the internal orifice through feces for maintenance. Intestinal microorganisms entering the anal canal will cause acute inflammation and spread along the internal longitudinal path (such as perianal abscess) [1].

The study of the distribution of bacteria in perianal abscess is conducive to the clinical diagnosis, pathogenesis, and treatment of perianal abscess. Therefore, this study uses meta-analysis to combine the research results at home and abroad in order to provide a basis to guide the diagnosis and treatment of perianal abscess related diseases.

2. Materials and methods

2.1. General information

2.1.1. Literature retrieval and retrieval strategy

By searching 7 major databases at home and abroad, the included literatures were extracted after data screening, and literatures on the distribution of perianal abscess published in each database since 2010 were collected. The search criteria included English terms, such as "perianal," "perianorectal," "microbiology," and "bacteria," as well as Chinese keywords, such as "肛周脓肿," "肛管直肠周围脓肿," "细菌," and "菌群."

2.1.2. Inclusion criteria

The inclusion criteria were as follows: (1) bacterial samples of pus from patients with a clear diagnosis of perianal abscess; (2) cross-sectional study as the research method; (3) clear number and type of bacterial culture as well as perfect original data; (4) literatures that were published after 2010.

2.1.3. Exclusion criteria

The exclusion criteria were as follows: (1) the number of specimens in the study was less than 70; (2) conferences, abstracts, and other literatures with incomplete pathogen data and were unable to conduct data analysis; (3) the publication time of the literature does not meet the time limit (including literatures that were published after 2010).

2.2. Methods

2.2.1. Data extraction

The basic information (author's name, publication time, country, region, sample size, bacterial classification, and sample number) of each document was extracted (**Table 1**). A total of 1,771 bacterial culture specimens of perianal abscess from 11 literatures were included in this study (30 invalid samples) [2-12]. The types of bacteria obtained in various literatures were different. Through screening and excluding the bacteria without research significance (number of bacteria detected was less than 3; bacterial culture of individual studies), it was concluded that the main pathogenic bacteria detected in various studies were Escherichia coli, Klebsiella pneumoniae, and Staphylococcus. The detection rates for these three pathogens were analyzed by meta-analysis.

Table 1. Basic information of each literature and flora distribution

name	Publshing Time	Nation	sample size	male	femlae	years	Escherichia coli	Klebsiella pneumoniae	Staphylococcus	streptococcus	Pseudomonas copper	enterococcus	Morganella
Qian Cao	2019	China	78	78	22	1-82	45	11	8	0	0	2	0
Xinying Zhang	2019	China	217	—	—	—	152	31	5	8	2	1	0
Feng Wu	2018	China	280	250	30	4-80	184	44	5	0	3	1	0
Jasim Alabbad	2018	Kuwait	148	—	—	—	78	18	26	9	1	8	3
Hongna Ren	2018	China	109	—	—	4-73	43	18	11	8	0	13	0
Xingwei Sun	2018	China	124	114	31	15-65	90	16	3	4	0	0	1
Jinhui Gu	2017	China	156	130	16	12-72	110	18	12	2	0	3	0
Xuecheng Zhang	2016	China	322	—	—	—	137	42	49	13	27	26	0
Saijun Wang	2014	China	91	203	39	15-64	77	11	0	0	0	0	0
Chaolan Luo	2013	China	70	60	16	17-68	54	18	7	10	0	4	0
Yenv Shou	2013	China	176	136	72	-	128	23	3	0	0	0	2

2.2.2. Statistical analysis

Meta-analysis was performed by STATA 12.0 statistical software. The effect variable was the detection rate of the three pathogens. The combined statistics of the rates and the 95% confidence interval (CI) were calculated. The heterogeneity of the literatures was evaluated by I^2 test. $p \geq 0.1$ indicates heterogeneity among the literatures, and the fixed effect model would be used. However, $p < 0.1$ indicates heterogeneity in each study, and the random effect model would be used. Publication bias was evaluated by the symmetry of the funnel plot.

3. Results

3.1. Literature search results

A total of 221 domestic and foreign literatures were retrieved in this research, including 114 literatures in the Chinese language and 107 in the English language. Through reading the full text, the articles were screened according to the inclusion and exclusion criteria. In regard to the publication time, 89 papers, 29 conference abstracts, 71 papers with less than 70 samples, and 21 papers with unclear bacterial classification were excluded. A total of 11 literatures met the inclusion and exclusion criteria [2-12] and were included in this meta-analysis as shown in **Figure 1**.

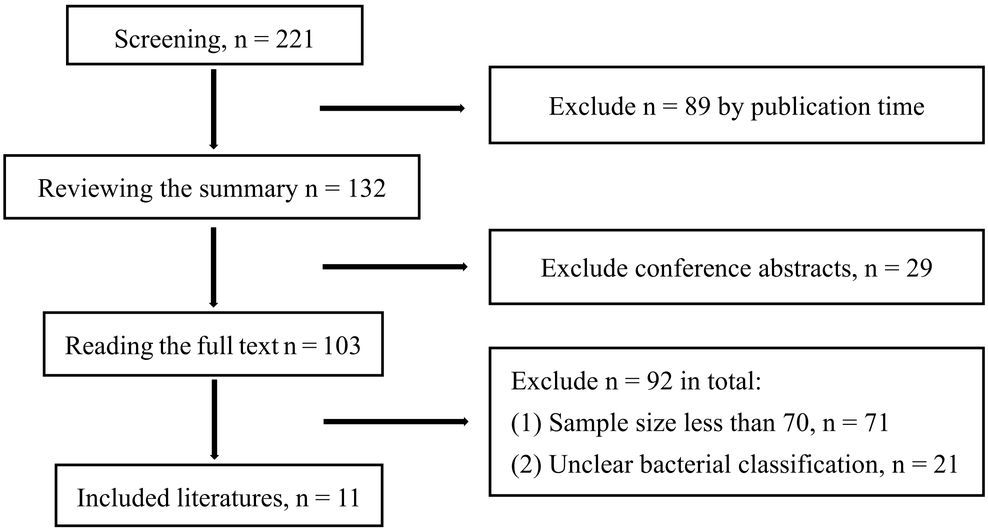

Figure 1. Literature search process

3.2. Statistical analysis results

3.2.1. Bacterial detection rates

The detection rates and heterogeneity evaluation of combined Escherichia coli, Klebsiella pneumoniae, and Staphylococcus were 65% (95% CI, 0.56-0.74), 14% (95% CI, 0.12-0.16), and 7% (95% CI, 0.04-0.10), respectively as shown in **Figure 2**, **Figure 3**, and **Figure 4**.

3.2.2. Heterogeneity evaluation

As shown in **Figure 2** and **Figure 4**, there is heterogeneity in the detection rates of Escherichia coli and Staphylococcus, indicating that there are differences among the studies. The random effect model was adopted. The heterogeneity of Klebsiella pneumoniae is shown in **Figure 3**, where the heterogeneity among the studies is significantly lesser compared to the first two; thus, the fixed effect model was adopted.

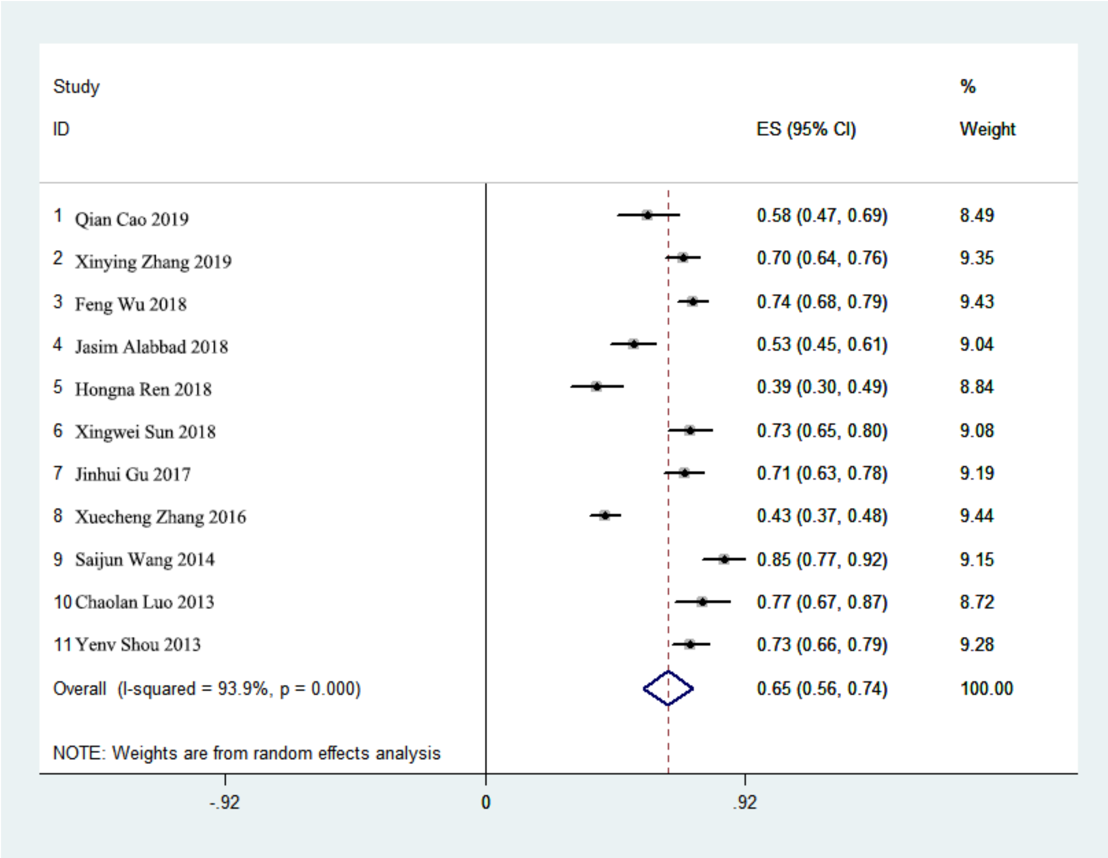

Figure 2. Meta-analysis of the detection rate of Escherichia coli

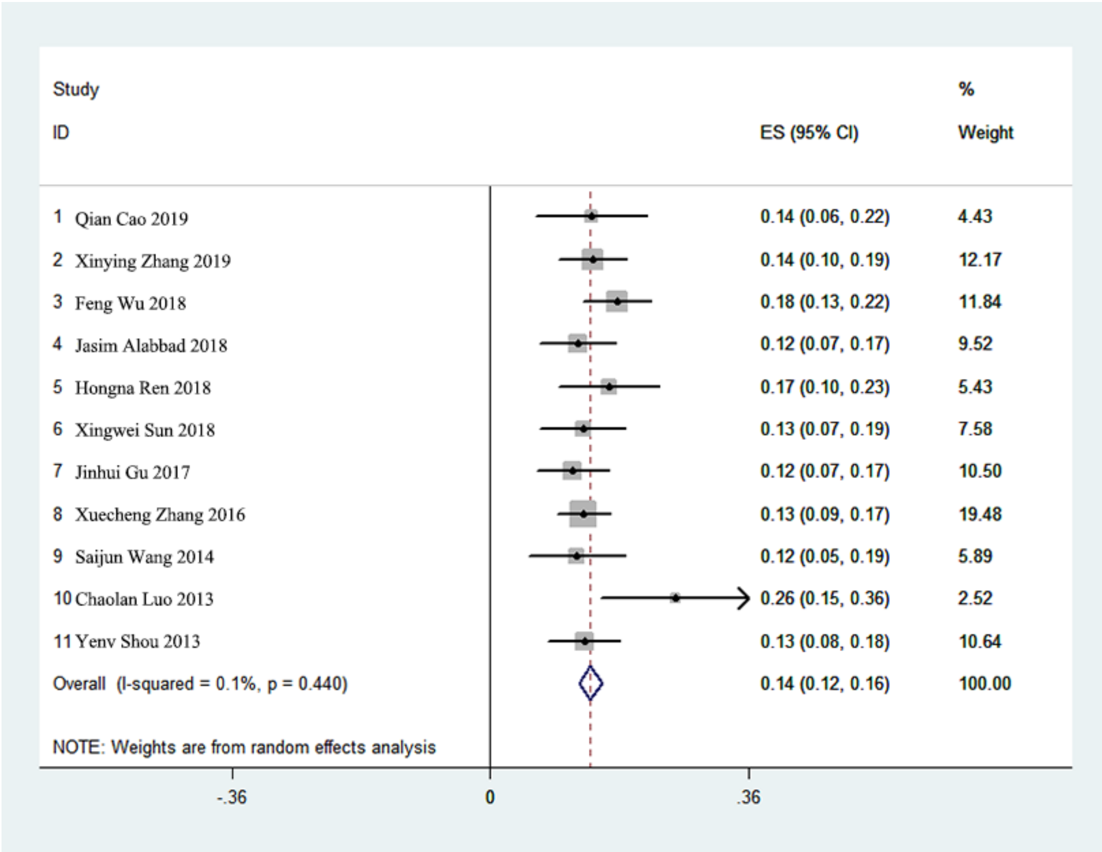

Figure 3. Meta-analysis of the detection rate of Klebsiella pneumoniae

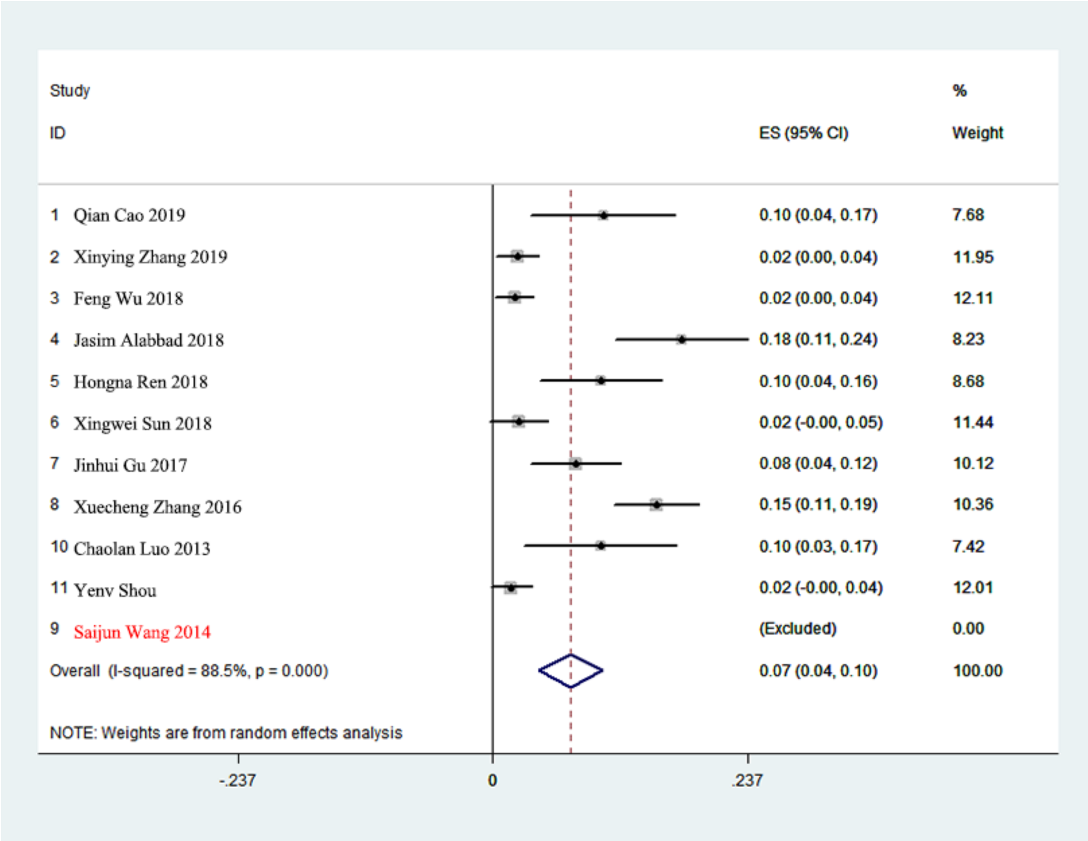

Figure 4. Meta-analysis of the detection rate of Staphylococcus

3.2.3. Publication bias

The publication bias is shown in **Figure 5**, **Figure 6,** and **Figure 7**, where the funnel plots show a certain publication bias.

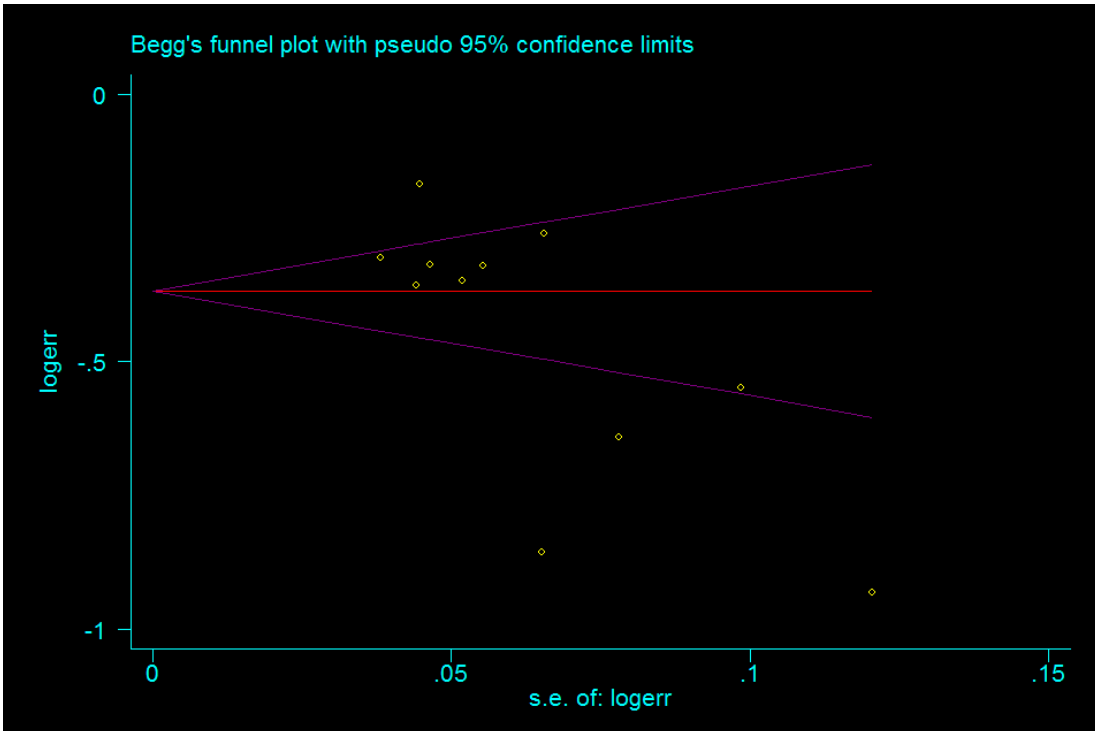

Figure 5. Funnel plot of the publication bias of Escherichia coli detection rate in each study

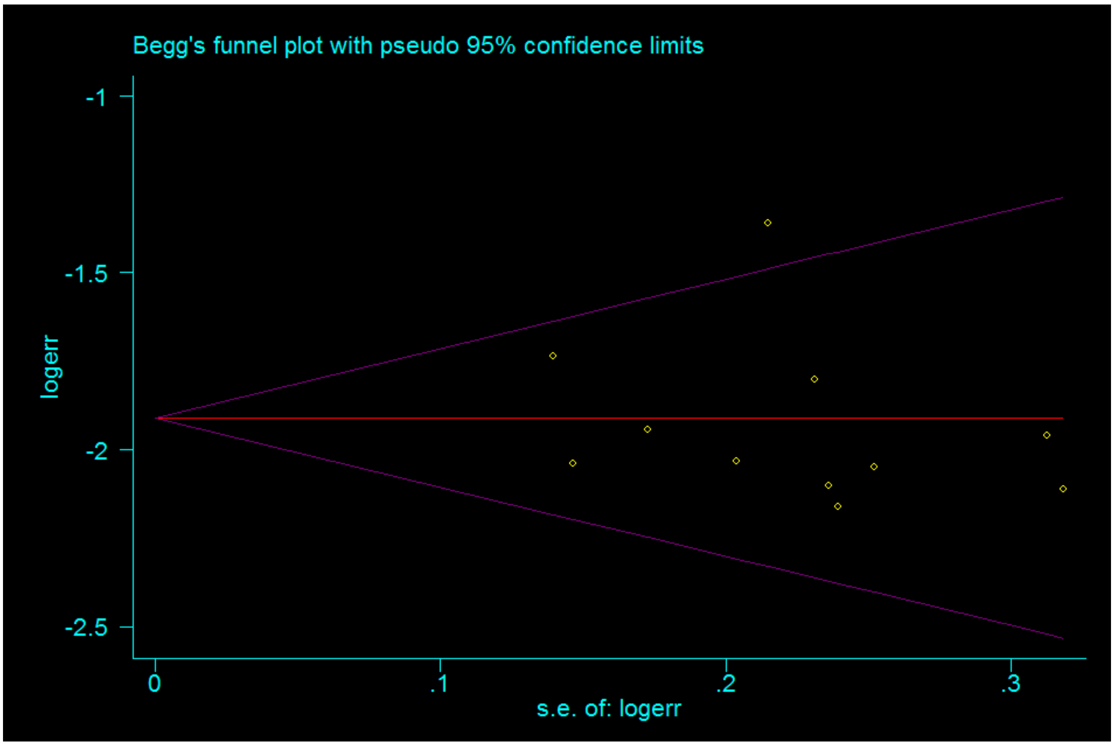

Figure 6. Funnel plot of the publication bias of Klebsiella pneumoniae detection rate in each study

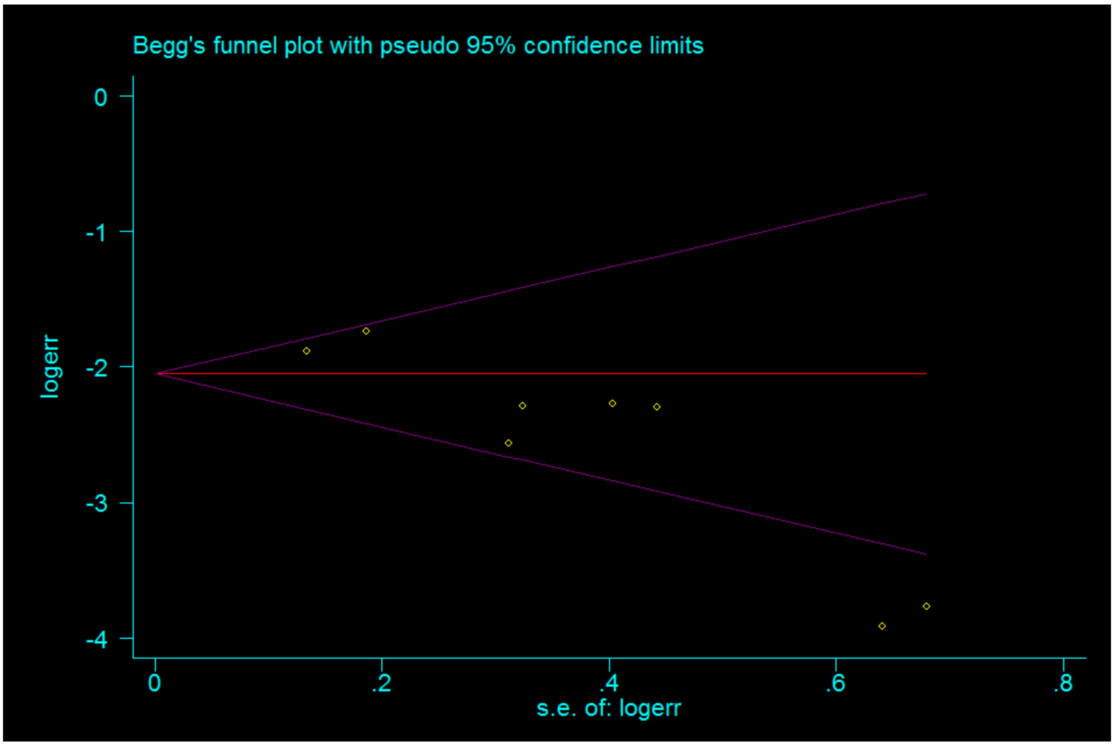

Figure 7. Funnel plot of the publication bias of Staphylococcus detection rate in each study

4. Discussion

In this study, the detection rates of the three main pathogens (Escherichia coli, Klebsiella pneumoniae, and Staphylococcus) in 11 literatures [2-12] at home and abroad about the distribution of bacteria in perianal abscess were combined by meta-analysis. The results showed that Escherichia coli, Klebsiella pneumoniae, and Staphylococcus were the main bacteria in the bacterial distribution of perianal abscess, and the detection rate of Escherichia coli was the highest, 0.65, indicating that Escherichia coli is the main pathogenic bacteria in the disease process of perianal abscess.

It was also found that many patients preferred the surgical method of incision and drainage (I&D) due to the inconveniences from work and life. There were no clear guidelines for the use of antibiotics after incision and drainage. They use of antibiotics was only for special cases, such as extensive cellulitis [13]. There were many debates about the etiology and prevention of recurrent perianal abscess, especially the role of antibiotics in the development of anal fistula after incision and drainage. Leila Ghahramani and other researchers evaluated the role of postoperative antibiotics in the prevention of anal fistula after I&D of perianal abscess in their study; there was a significant reduction in the rate of fistula formation among the patients that received preventive antibiotics [14]. Meanwhile, in a study carried out by Valentin Mocanu and other researchers, it was found that antibiotic treatment after incision and drainage of anorectal abscess can reduce the probability of fistula formation by 36%, and the use of antibiotics for 10 days after postoperative drainage can avoid the incidence of fistula formation in other healthy patients [15]. However, unnecessary antibiotics can also cause allergic reactions and side effects in patients [16]. Although this controversy exists, local and foreign literatures have suggested that bacterial analysis of perianal abscess has certain enlightenment and plays a guiding role in the use of antibiotics after perianal abscess drainage and in patients who do not meet surgical indications. Therefore, the bacterial analysis of perianal abscess has a certain research significance in clinical practice and experiments, but it requires scientific and standardized collection as well as correct statistical analysis.

Due to the majority of Chinese literatures included, the representativeness of the literature research and data analysis has regional limitations. In addition, the heterogeneity of various studies is large. The main reason is that there are obvious differences in the research subjects, research time, and sample size among the studies. The bacterial distribution obtained in this study can provide a certain basis for antibiotic treatment in clinical practice. The specific mode and dose selection require further clinical exploration and experimental research.

Disclosure statement

The authors declare that there is no conflict of interest.

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