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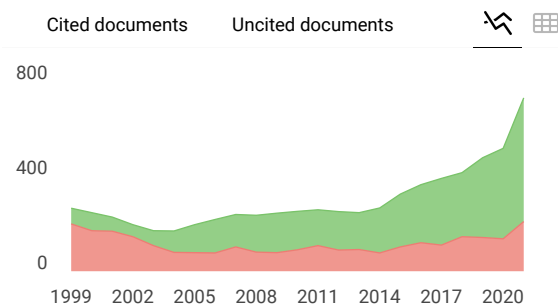
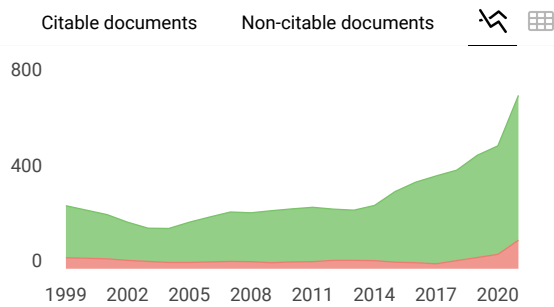
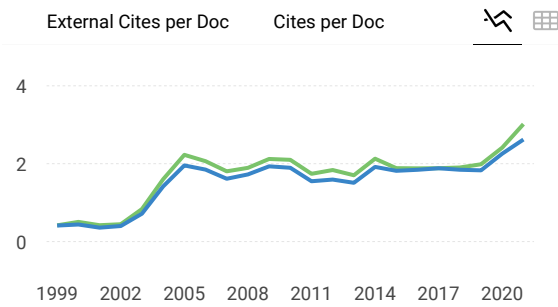
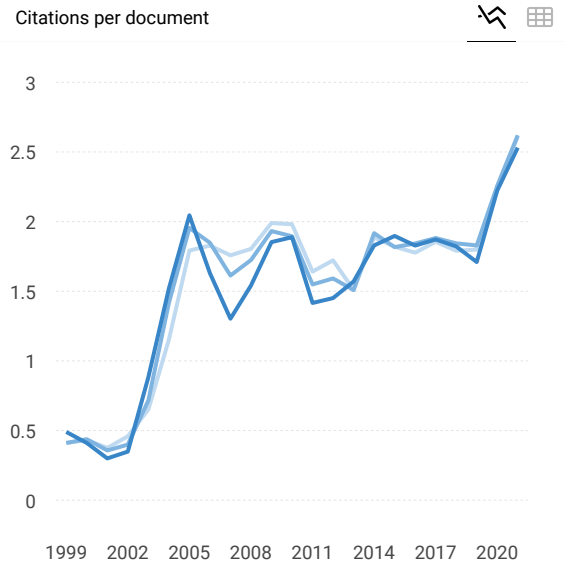
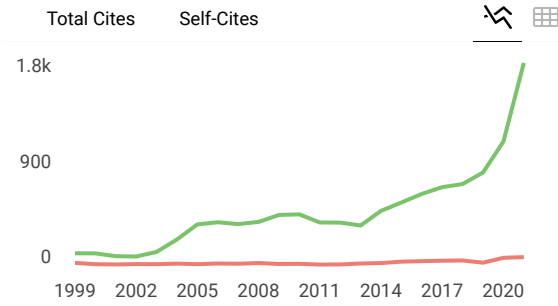
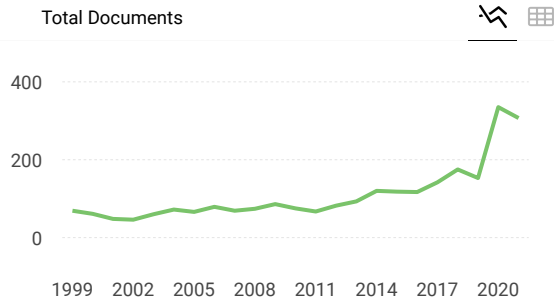
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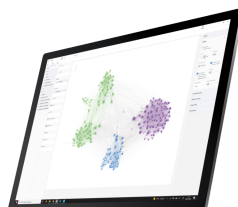
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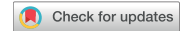


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Intralesional measles–mumps–rubella is associated with a higher complete response in cutaneous warts: a systematic review and meta-analysis of randomized controlled trial including GRADE qualification

Rachel Vania^a, Raymond Pranata^a  and Sukmawati Tansil Tan^b 

^aFaculty of Medicine, Universitas Pelita Harapan, Tangerang, Indonesia; ^bDepartment of Dermatovenerology, Faculty of Medicine, Universitas Tarumanegara, Jakarta, Indonesia

ABSTRACT

Introduction: Warts can be difficult to treat and progressing to chronic and resistant disease. Several studies have reported the successful application of mumps–measles–rubella (MMR) vaccine resulting in clearance of warts *via* immunomodulation and induction of immune system.

Methods: We performed a comprehensive search on the role of intralesional MMR in warts from several electronic databases. Complete response is defined as complete clearance of warts lesion.

Results: There were a total of 425 subjects from five studies. Intralesional injection of MMR was associated with an increased complete response (OR 9.43 [5.78, 15.37], $p < .001$; I^2 : 5%, $p = .38$). Subgroup analysis on patients receiving injection for every 2 weeks for a maximum of five injections revealed an OR of 11.70 [6.40, 21.38], $p < .001$; I^2 : 20%, $p = .29$. Patients receiving intralesional MMR were associated with a lower partial response (OR 0.54 [0.33, 0.88], $p = .01$; I^2 : 0%, $p = .66$). Intralesional MMR was associated with a reduced no-response (OR 0.16 [0.06, 0.43], $p < .001$; I^2 : 69%, $p = .01$). Funnel plot analysis for complete response was asymmetrical, indicating the risk of publication bias. There were statistically significant small-study effects for intralesional MMR on complete response upon analysis using Harbord's test ($p = .047$). Grading of Recommendations Assessment, Development and Evaluation (GRADE) assessment showed that intralesional MMR injection has high level of certainty (quality of evidence) for complete response in warts with an absolute increase of 505 per 1000.

Conclusion: Intralesional MMR injection was associated with a higher complete response and lower no-response with a high level of certainty.

ARTICLE HISTORY

Received 8 December 2019
Accepted 9 January 2020

KEYWORDS

Intralesional MMR;
measles–mumps–rubella;
warts

Introduction

Warts is a cutaneous manifestation of human papillomavirus (HPV) infection (1). There are over 100 types of the virus that have preferences for predilection (2). The most common HPV types for common warts are 1, 2, 4, 27, 57, while 1, 2, 4, 63 for plantar warts and 3, 10, 27, 41 for flat warts (3). The lesion erupts as firm papule, 1–10 mm, hyperkeratotic, clefted surface with vegetation, can be flat or shiny (3).

The disease is typically chronic, progresses overtime in size, and spreads to other body parts, becoming more resistant to treatment (4). The disease is associated with a high recurrence and relapse, leading to cosmetic disfigurement, diffident, anxiety, and other psychological discomfort. Removal of symptomatic warts is necessary, but does not clear the viral infection (3). Although the majority are healed spontaneously, there is no single therapy that proves superiority in chronic warts (2). Therefore, multiple approaches are required for therapeutic management.

A Cochrane pooled review found for the efficacy of topical 5-fluorouracil, intralesional interferons and photodynamic therapy (5). However, they are potentially hazardous or toxic treatments and result in more pain than the lesion itself; therefore, careful consideration on the benefit-to-risk ratio is advised (1,3,6). The reported locally destructive treatment encompassing caustic

agents (ablation, cryotherapy, salicylic acid) to antiproliferative agents have reported variable range of clearance rate, but ultimately results in scarring (7,8). Meanwhile, a systemic immunotherapeutic maneuvers such as intralesional antigens and vaccines have gained interest for a higher efficacy with tolerable side effects (8–13). Several trials have shown the successful application of mumps–measles–rubella (MMR) vaccine resulting in complete clearance of warts (14), defined as eradication of the treated area. It is hypothesized that the vaccine increases the ability of the immune system to recognize and destroy the antigen and infected cells, while establishing efficacy and safety (7,14). In this systematic review and meta-analysis, we aimed to collect the latest evidence on the efficacy of MMR vaccine as immunotherapy for cutaneous warts.

Methods

Search strategy

We performed a comprehensive search on topics that assesses intralesional MMR injection compared to normal saline in patients with warts keywords ['MMR' and 'warts'] and its synonym from inception up until November 2019 through PubMed, Europe PMC, ScienceDirect, ProQuest, Clinicaltrials.gov, and hand-sampling from potential articles cited by other studies.

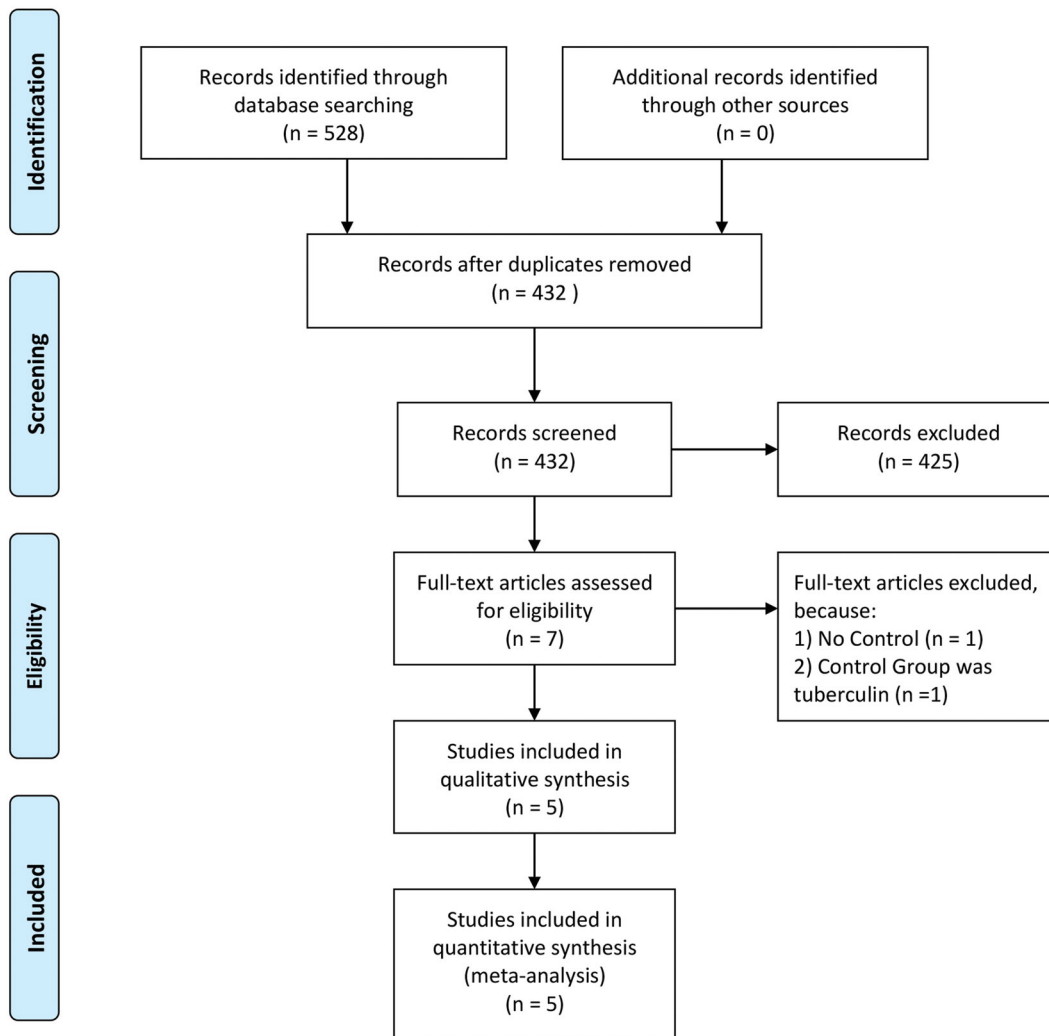


Figure 1. Study flow diagram.

The records were then systematically evaluated using inclusion and exclusion criteria. We also performed hand-sampling from references of the included studies. Two researchers (RP and RV) independently performed an initial search, discrepancies were resolved by discussion. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart of the literature search strategy of studies was presented in Figure 1.

Selection criteria

The inclusion criteria for this study is all studies that assess intralesional MMR injection compared to normal saline in patients with warts. We included all related clinical researches/original articles and excluded case reports, review articles, and non-English language articles.

Data extraction

Data extraction and quality assessment were done by two independent authors (RP and RV) using standardized extraction form, which includes authors, year of publication, study design, fundings, subject characteristics, MMR dose and protocol, gender, age, complete response, partial response, no response, and follow-up duration.

Outcome

Primary outcome of this study is complete response, defined as complete clearance of warts lesion.

Statistical analysis

To perform the meta-analysis, we used RevMan software, version 5.3 (Cochrane Collaboration) and STATA/MP 14.0 (StataCorp LP). We used the odds ratio (OR) and a 95% CI as a pooled measure for dichotomous data. Inconsistency index (I^2) test, which ranges from 0 to 100%, was used to assess heterogeneity across studies. A value above 50% or $p < .05$ indicates statistically significant heterogeneity. We used the Mantel-Haenszel method for OR with a fixed-effect model for meta-analysis, and a random-effect model was used in case of heterogeneity. Adjusted ORs from the studies were pooled using inverse variance. Small-study effect was assessed using a regression-based test (Harbord's test) for binary outcomes. All p -values were two-tailed with a statistical significance set at 0.05 or below. The certainty of the evidence was assessed by using the Guideline Development Tool by GRADEpro GDT.

Results

We found a total of 528 results. There were 432 records after removal of duplicates. A total of 425 records were excluded after screening the title/abstracts. After assessing seven full-text for eligibility; we excluded two because (i) no control ($n=1$) and (ii) control group was tuberculin ($n=1$). We included five studies in qualitative synthesis and meta-analysis (Figure 1). All five studies were randomized controlled trials (RCTs). There were a total of 425 subjects from five studies (Table 1).

Study characteristics

Two studies are double-blind RCT, two are single-blind, and one is unclear blind. The cutaneous warts were observed in all studies, two studies included both recalcitrant and non-recalcitrant warts, one study included recalcitrant, and two studies did not specify. The protocol was used in varying dose, ranging from 0.1 (depends on the skin test reaction) to 0.5 mL, every 2–3 weeks, for maximum dose of three to five times. The mean age was 28.44 ± 10.33 in MMR group and 28.5 ± 9.83 in control group (p -value for difference = .955). Most studies followed the patients for 6 months, except one study which only observed the patients for 16 weeks.

Complete response

The pooled rate of complete response for the intralesional MMR injection from five studies was 73% (67–79%) (Figure 2(A)) of the patients. Compared to placebo, intralesional injection of MMR was associated with an increased complete response (OR 9.43 [5.78, 15.37], $p < .001$; I^2 : 5%, $p = .38$) (Figure 2(B)). Subgroup analysis on patients receiving injection for every 2 weeks for a maximum of five injections revealed an OR of 11.70 [6.40, 21.38], $p < .001$; I^2 : 20%, $p = .29$.

Partial response

Patients receiving intralesional MMR were associated with a lower partial response (OR 0.54 [0.33, 0.88], $p = .01$; I^2 : 0%, $p = .66$) (Figure 2(C)).

No response

Intralesional MMR was associated with reduced no-response (OR 0.16 [0.06, 0.43], $p < .001$; I^2 : 69%, $p = .01$) (Figure 2(D)). Upon sensitivity analysis, no removal of single study reduced heterogeneity.

Adverse events

Influenza-like symptoms, pain at the injection site are the most common complications. There seems to be no difference in the rate of pain at injection between MMR and control group, both reached up to 100%. Pooled estimate for influenza-like symptoms occurrence was 8% (4–12%) in the MMR group.

Publication bias

The risk of bias assessment showed that the risk was high in the blinding of participants due to the single-blind nature of

Table 1. Summary of studies included in the systematic review.

Author	Study design	Warts type and location	Recalcitrant warts (%)	MMR dose	MMR protocol	Placebo	Sample size (n)	Age	Male (%)	Follow-up	Funding
Rezaei (2019) ⁴	Single-blind RCT	Resistant to therapy Palmo Plantar warts	100	Intralesional injection of 0.1–0.3 mL (depending on test reaction) of MMR vaccine	Every 2 weeks for a maximum of five injections	Intralesional NS 0.3 mL	60 (30/30)	27.2 ± 8.73 vs. 25.37 ± 9.23	40 vs. 36.7	6 months	Ozra Asqary Marzidareh's thesis for general medicine
Agrawal (2018) ^[15]	Double-blind RCT	Extragenital warts	N/a	Intralesional injection of 0.3 mL of MMR vaccine	Every 3 weeks for a maximum of three injections	Intralesional NS 0.3 mL	60 (30/30)	25 ± 9.5 vs. 27 ± 8.9	63 vs. 57	6 months	None
Awal (2018) ^[16]	Single-blind RCT	Extragenital warts	52.7 vs. 56	Intralesional injection of 0.5 mL of MMR vaccine	Every 2 weeks for a maximum of five injections	Intralesional NS 0.5 mL	122(72/50)	28.9 ± 9.4 vs. 33.6 ± 9.2	55 vs. 54	16 weeks	None
Zamanian (2014) ²	Double-blind RCT	unspecified	N/a	Intralesional injection of 0.5 mL of MMR vaccine	Every 2 weeks for a maximum of three injections	Intralesional NS 0.5 mL	48 (24/24)	18.9 ± 12 vs. 20.1 ± 10	54.2 vs. 54.5	6 months	None
Nofal (2010) ¹	RCT (unclear blinding status)	Single or multiple, recalcitrant or non-recalcitrant common warts	21.4 vs. 15	Intralesional injection of 0.1–0.3 mL (depending on test reaction) of MMR vaccine	Every 2 weeks for a maximum of five injections	Intralesional NS 0.3 mL	135 (85/50)	32.4 ± 9.3 vs. 30.2 ± 7.8	31 vs. 17	6 months	None

MMR: measles-mumps-rubella; NS: normal saline; RCT: randomized controlled trial.

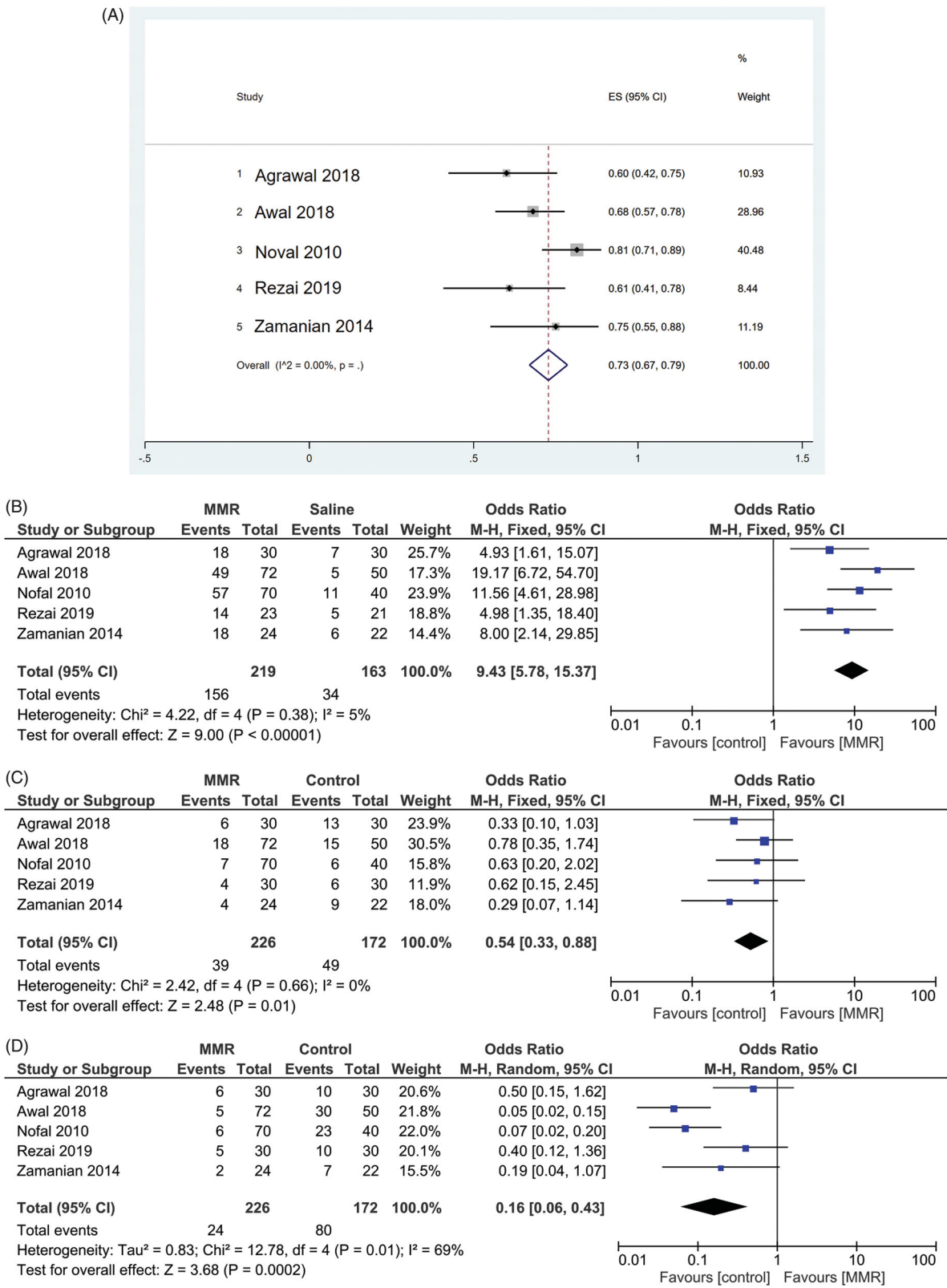


Figure 2. MMR vaccine and wart response. Complete response rate in MMR group was demonstrated in (A). Increased complete response was found in patients receiving MMR vaccine (B). Partial response (C), and nonresponse (D) was higher in placebo group. MMR: measles–mumps–rubella.

the studies. The risk of bias assessment for the studies is presented in Figure 3(A). Funnel plot analysis for complete response was asymmetrical, indicating the risk of publication

bias (Figure 3(B)). There were statistically significant small-study effects for intralesional MMR on complete response upon analysis using Harbord’s test ($p = .047$) (Figure 3(C)).

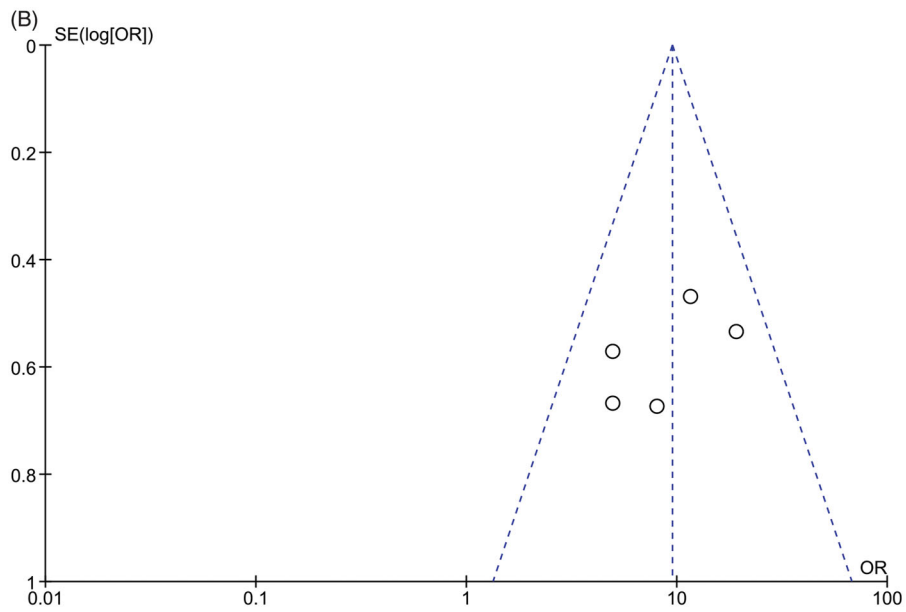
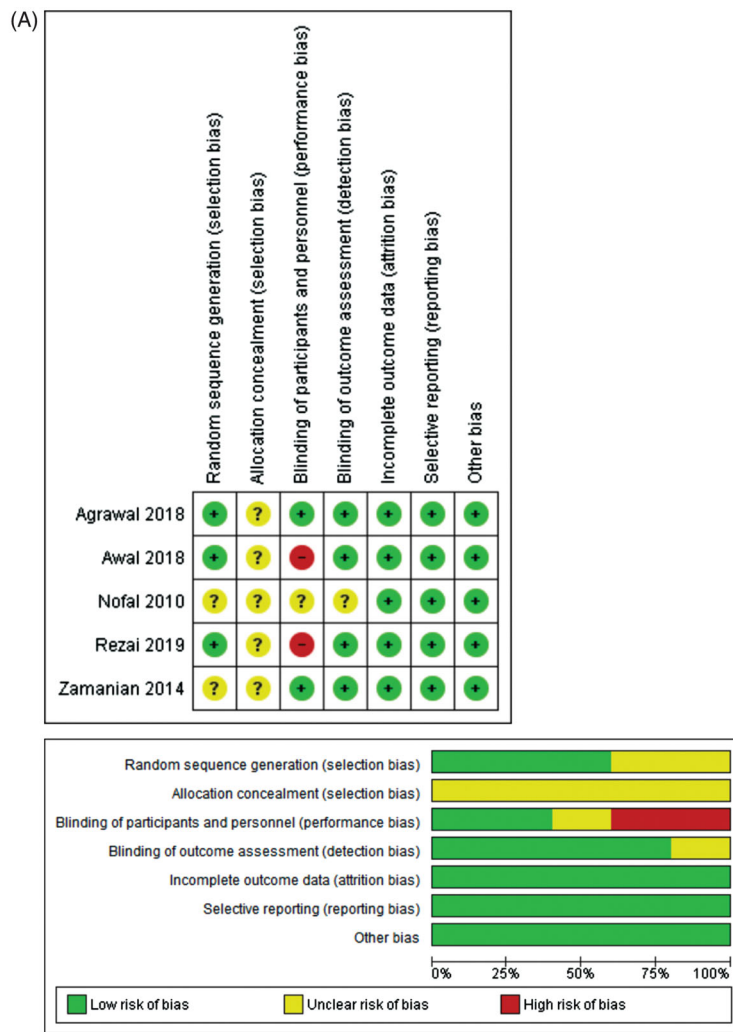


Figure 3. Risk of bias assessment. Cochrane risk of bias analysis is shown in (A). Funnel plot was asymmetric, showing an increased risk of publication bias (B). Harbord’s test showed a statistically significant small-study effect (C).

Table 2. GRADE assessment.

No. of studies	Certainty assessment					No. of patients			Effect		
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	MMR	Placebo	Relative (95% CI)	Absolute (95% CI)	Certainty
5	Randomized trials	Serious ^{a,b,c}	Not serious	Not serious	Not serious	Publication bias strongly suspected very strong ^{b,c} association	156/219 (71.2%)	34/163 (20.9%)	OR 9.43 (5.78 to 15.37), $p < .001$	505 more per 1,000 (from 395 more to 593 more)	⊕⊕⊕⊕ HIGH

CI: confidence interval; MMR: Measles-Mumps-Rubella ; OR: odds ratio.

^aSingle-blind trial.

^bAsymmetrical funnel plot.

^cPossible small-study effect.

therefore the procedure is more comfortable for the patient comparing to other current treatments 15,16.

There is a possibility of publication bias because there is a significant small-study effect. Different prevalence of recalcitrant warts among the studies may affect the effect size of primary outcome. Unfortunately, meta-regression cannot be performed due to limited number of studies ($n < 10$). All studies were conducted in the Middle Eastern countries. Therefore, future research in other regions is necessary to represent other population. The long term efficacy is not yet established, due to short follow-up period. The authors recommend a lengthier follow-up period to assess long term efficacy and safety of intralesional MMR.

Conclusion

Intralesional injection of MMR was associated with complete response of warts in short to midterm and tolerable side effects. The adverse events in the MMR group were low and tolerable. The evaluation showed that intralesional MMR injection has a high level of certainty (quality of evidence) for complete response in warts.

Disclosure statement

The authors declare that they have no conflict of interests.

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References

- Bacelieri R, Johnson SM. Cutaneous warts: an evidence-based approach to therapy. *Am Fam Physician*. 2005;72:647–652.
- Mobasher P, Zamanian A. Efficacy of intralesional injection of mumps-measles-rubella vaccine in patients with wart. *Adv Biomed Res*. 2014;3:107.
- Human papilloma virus infection. In: Wolff K, Johnson RA, editor. *Fitzpatrick's color atlas & synopsis of clinical dermatology*. 8th ed. New York (NY): McGraw-Hill Education; 2017. p. 656–665.
- Rezai MS, Ghasempouri H, Asqary Marzidareh O, et al. Intralesional Injection of the measles-mumps-rubella vaccine into resistant palmoplantar warts: a randomized controlled trial. *Iran J Med Sci*. 2019;44:10–17.
- Gibbs S, Harvey I, Sterling J, et al. Local treatments for cutaneous warts. *Cochrane Database Syst Rev*. 2003. Article Number: CD001781.
- Gibbs S, Harvey I. Topical treatments for cutaneous warts. *Cochrane Database Syst Rev*. 2012. Article Number: CD001781.
- Rivera A, Tying SK. Therapy of cutaneous human Papillomavirus infections. *Dermatol Ther*. 2004;17:441–448.
- Leeyaphan C, Tantrapornpong P, Ungprasert P. The efficacy of diphenycprone immunotherapy for the treatment

- of cutaneous warts: a systematic review and meta-analysis. *J Dermatolog Treat.* 2019.
9. Khozeimeh F, Jabbari Azad F, Mahboubi Oskouei Y, et al. Intralesional immunotherapy compared to cryotherapy in the treatment of warts. *Int J Dermatol.* 2017;56: 474–478.
 10. Majid I, Imran S. Immunotherapy with intralesional *Candida albicans* antigen in resistant or recurrent warts: a study. *Indian J Dermatol.* 2013;58:360.
 11. Milante RR, Venida-Tablizo A, King-Ismael D. Efficacy and safety of single versus multiple intralesional immunotherapy with purified protein derivative (PPD) in the treatment of multiple verruca vulgaris. *Int J Dermatol.* 2019;58: 1477–1482.
 12. Chandra S, Sil A, Datta A, et al. A double-blind, randomized controlled trial to compare the effectiveness and safety of purified protein derivative of tuberculin antigen with Mycobacterium w vaccine in the treatment of multiple viral warts. *Indian J Dermatol Venereol Leprol.* 2019;85:355.
 13. Vlahovic TC, Spadone S, Dunn SP, et al. Candida albicans Immunotherapy for Verrucae Plantaris. *J Am Podiatr Med Assoc.* 2015;105:395–400.
 14. Nofal A, Nofal E. Intralesional immunotherapy of common warts: successful treatment with mumps, measles and rubella vaccine. *J Eur Acad Dermatology Venereol.* 2010; 24:1166–1170.
 15. Agrawal C, Vyas K, Mittal A.A Randomized double Blind Controlled Study Comparing the Efficacy of Intralesional MMR Vaccine with Normal Saline in the Treatment of Cutaneous Warts. *Indian Dermatol Online J.* 2018;9(6):389
 16. Awal G, Kaur S. Therapeutic Outcome of Intralesional Immunotherapy in Cutaneous Warts Using the Mumps, Measles, and Rubella Vaccine: A Randomized, Placebo-controlled Trial. *J Clin Aesthet Dermatol.* 2018;11(5):15
 17. Chauhan PS, Mahajan VK, Mehta KS, et al. The efficacy and safety of intralesional immunotherapy with measles, mumps, rubella virus vaccine for the treatment of common warts in adults. *Indian Dermatol Online J.* 2019;10: 19–26.