ISSN: 2754-5016

Journal of Immunology Research & Reports

SCIENTIFIC Research and Community

Research Article

Open Access

# Platelet-Rich-Plasma Indication and Effects in Infertile Women

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**ABSTRACT**

This paper summarises the present knowledge about the Platelet Rich Plasma (PRP) used as support in the therapy of women infertility. The results of PRP used in orthopedy, therapy of acute injuries (sport activities), persistent wounds with healing problems, in dermatology (hair losing) and stomatology suggested the possibility of PRP use in primary infertility and ART failure. The first indication was thin endometrium with positive effect as increase of the endometrium thickness associated with better chance for the pregnancy. The injection of PRP into ovary tissue is resulting in ovarian rejuvenation associated with improving the maturation of the oocytes and increase of ovarian reserve. However, these effects were transient in part of women. The study of PRP used in revitalisation of ovary despite of increased number of oocytes was not associated with increase of successful pregnancies rates. In our study of 25 women diagnosed with infertility the use of PRP in ART 5 women gave the birth of healthy children. This result showed the use of PRP in ART therapy of infertility in the method increasing chance for the successful pregnancy.

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**Received:** October 06, 2026; **Accepted:** October 09, 2026; **Published:** October 19, 2026

**Keywords:** Platelet-Rich-Plasma, Infertile Women, Growth Factor, Tumour Necrotic Factor, Regenerative Medicine, Platelet Rich Plasma

**Abbreviations**

**PDGF:** Platelet-Derived Growth Factor
**TGF-b:** Transforming Growth Factor
**CXCL4:** Platelet Factor 4
**CXCL7:** Neutrophil Activating Peptide 2 – NAP-2
**IGF-1:** Insulin-Like Growth Factor -1
**EGF:** Epidermal Growth Factor
**VEGF:** Vascular Endothelial Growth Factor
**PGE2:** Prostaglandin E
**CD40-CD40:** Ligand-Receptor and Ligand Interaction between B and T Lymphocytes
**CCL5:** Cysteine Containing Chemokine
**IL:** Interleukins
**TNF:** Tumour Necrotic Factor
**LP-PRP:** Leukocyte Poor- Platelet Rich Plasma
**LR-PRP:** Leukocyte Rich - Platelet Rich Plasma
**MSC:** Mesenchymal Stem Cells
**POI (POF):** Premature Ovarian Insufficiency/Failure
**POR:** Poor Ovarian Reserve
**IVF:** In Vitro Fertilisation
**LBR:** Live Birth Rate

## Introduction

### Platelets Their Properties and Function

The platelets are anucleate morphotic elements of peripheral blood produced by megakaryocytes in bone marrow. After 2-3 days of circulation in the peripheral blood there are eliminated mainly by the spleen. The platelets are containing and secreting the list of biologically active substances including growth factors, proteins activating the clotting process, adhesion molecules, cytokines and chemokines. The main role of platelets is repairing of the vascular walls, the support of wound healing after activation by the collagen exposed after the endothelial injury. Active platelets secrete pro-coagulative mediators e.g. ADP, thrombine, prostaglandins, PDGF. These factors are imported for the stimulation of the migration of platelets number to the injury place together with activated neutrophils, lymphocytes and erythrocytes.

During this process is probably more than 800 different proteins secreted into the surrounding media with the paracrine effect on cells like: myocytes, tendon cells, mesenchymal cells from different origin, chondrocytes, fibroblasts and endothelial cells. Among different secreted factors is PDGF very important for the process of wound healing. The list of platelets derived cytokines include pro-inflammatory and anti-inflammatory (inhibiting) cytokines e.g. TFGb and IL-10 as the most active. The cooperation between platelets and neutrophils is mediated by the chemokines – CXCL4 i CXCL7 secreted by platelets and supporting chemotactic activity of neutrophils described in the acute injury of lung tissue. The uptake and the elimination of pathogens with the extracellular neutrophilic trap's formation is possible with active assist of the platelets. The interaction between platelets and neutrophils leading to covering of neutrophils with platelets is inductive for the migration of inflammatory active monocytes to the place of tissue damage in a CD40-CD40 ligand-dependent mechanism.

The activation of different types of the cells with factors secreted by platelets is resulting in the regeneration of tissues, the wound healing and the repairing of vascular walls [1-5]. This regenerating role of platelets was the basic concept of use PRP in the regenerative medicine as the active and supporting factor.

Tables 1 and 2 show the platelets derived factors involved in the inflammation and regenerative processes.

**Tabel 1: The active Factors (Including Cytokines and Growth Factors) Released by Platelets without Stimulation or after Stimulation (acc. Amable 2013, Ribeiro 2019)**

| Platelets | Cytokines | Other active factors (chemokines, growth factors) |
|---|---|---|
| Without stimulations | IL-1b, IL-18, | PGE2, CXCL4, CCL5, CXCL7 |
| | | |
| Stimulated | IFN, IL-4, IL-8, IL-13, IL-17, TNF, IL-1b, IL-10 | PDGF- AA, -AB, -BB, TGF, EGF, VEGF, IGF-1, |
| (calcium chloride with or without thrombine) | | CCL5 (RANTES), CXCL4, granzyme-A, |

**Tabel 2: Selected List of PRP Based Growth Factors and Platelets Cytokines (acc. Everts 2020)**

| PGF and Cytokines | Cell Sources | Function and Effects |
|---|---|---|
| PDGF (AA-BB-AB) | Platelets, endothelial cells macrophages, smooth muscle cells | Mitogenic for mesenchymal cells and osteoblasts; stimulates chemotaxis and mitogenesis in fibroblast/ glial/smooth muscle cells; regulates collagenase secretion and collagen synthesis; stimulates macrophage and neutrophil chemotaxis |
| TGF | Macrophages, T cells, keratinocytes | Stimulates undifferentiated mesenchymal cell proliferation; regulates endothelial fibroblastic, and osteoblastic mitogenesis; regulates collagen synthesis and collagenase secretion; regulates mitogenic effects of other growth factors; stimulates endothelial chemotaxis and angiogenesis; inhibits macrophage and lymphocyte proliferation |
| VEGF | Platelets, macrophages, keratinocytes, endothelial cells | Increases angiogenesis and vessel permeability; stimulates mitogenesis for endothelial cells |
| EGF | Platelets, macrophages, monocytes | Proliferation of keratinocytes, fibroblasts, stimulates mitogenesis for endothelial cells |
| (a-b)-FGF | Platelets, macrophages, mesenchymal cells, chondrocytes, osteoblast | Promotes growth and differentiation of chondrocytes and osteoblasts; mitogenic for mesenchymal cells, chondrocytes and osteoblasts |
| CTGF | Platelets, fibroblasts | Promotes angiogenesis, cartilage regeneration fibrosis, and platelet adhesion |
| IGF-1 | Platelets, plasma, epithelial endothelial cells, fibroblasts osteoblasts, bone marrow matrix | Chemotactic for fibroblasts and stimulates protein synthesis. Enhances bone formation by proliferation and differentiation of osteoblasts |
| HGF | Platelets, mesenchymal cells | Regulates cell growth and motility in epithelial/endothelial cells, supporting epithelial repair and neovascularization during wound healing |
| KGF | Fibroblasts, mesenchymal cells | Regulates epithelial migration and proliferation |
| Ang-1 | Platelets, neutrophils | Induces angiogenesis stimulating migration and proliferation of endothelial cells. Supports and stabilizes blood vessel development via the recruitment of pericyte |

**Abbreviations:**
**PDGF:** Platelet-Derived Growth Factors; **TGF:** Transforming Growth Factor; **VEGF:** Vascular Endothelial Growth Factor; **EGF:** Epidermal Growth Factor; **FGF:** Fibroblast Growth Factor; **CTCG:** Connective Tissue Growth Factor; **IGF:** Insulin-Like Growth Factor; **HGF:** Hepatocyte Growth Factor; **KGF:** Keratinocyte Growth Factor; **Ang-1:** angiopoietin-1.

**PRP in Regenerative Medicine**
The observations of the platelets suspension (PRP) effects after the use for patients with the secondary thrombocytopenia during or after chemotherapy, due to leukaemia, lymphoma or another cancer disease, showed the wider results, more than only increase of platelets number. It was an indication for use the platelets as supporting treatment for the tissues regeneration and the wound healing process. At the beginning this platelets preparation was used in chronic bones and cartilages damage with poor healing.

The encouraging results of PRP in wound healing process expanded the indications for other chronic injuries e.g. due to diabetes (typical diabetic ulcers, diabetic feet), immunodeficiencies, cardiac insufficiency and secondary to oncological chemotherapy. PRP is often used in the orthopedy for acute injuries in active sportsmen, after communications accidents and any other problematic prolonged recovery process. Moreover, the effects of PRP in neo angiogenesis leading to reduction of healing time let to use PRP in the cosmetic and orthodontic procedures (e.g. surgery).

The improvement of bone and soft tissues (gingiva) healing post-operation and inhibition of gingival recession was shown. Similar results were noted when PRP was used for the therapy of hair loss as the cancer chemotherapy secondary effect. The improvement of overall hair growth and thickness with PRP was proven [6]. Nowadays, besides the above, the PRP are indicated for the complex therapy of the primary infertility, POI, ART failure and the unexplained miscarriages [7-11].

## PRP Methods of Separation

The platelets-rich plasma (PRP) is preparate from the patient's peripheral blood with centrifugation. Depending of the time, temperature and parameters of centrifugation the different suspensions are received – platelets rich leukocyte-poor (LP-PRP) or platelets rich leukocyte-rich (LR-PRP), what means higher or low number of leukocytes and erythrocytes together with concentrated platelets [1,2,12]. However, the problem of precise description, terminology and classifications of these platelets preparations from individual patients is still the open question [13].

In Table 3 The comparison of LP-PRP and LR-PRP parameters is shown [2].

**Tabel 3: Characteristics of Platelets Rich Plasma Preparations (acc. Parrish 2016)**

| Preparation | Mean number of platelets (thousand/ul) | Mean number of leukocyte (thousand/ul) | Mean number of erythrocytes (mln/ul) | Growth-factors released after stimulation with CaCl2 (pg/ml) EGF TGF PDGF VEGF |
|---|---|---|---|---|
| Normal blood | 224.3 | 4,9 | 4.04 | 2880 4280 35580 269 |
| LP-PRP | 485.9 | 1.0 | 0.05 | 2350 3908 29140 264 |
| LR-PRP | 1772.7 | 19.4 | 1.50 | 12475 19992 158480 1381 |

These differences between preparations of PRP are likely the be an effect of following mechanisms - the decrease of the platelets loading during separation with leukocyte exclusion due to the highly probable loss of platelets-leukocytes clusters, - bi-directional stimulation of platelets and leukocytes. This stimulation is associated with high level of active proteins, however, there are coming from both components – from the platelets and from the leukocytes. Concerning the role of these proteins (cytokines, growth factors, chemokines and other) in the tissue regeneration leukocyte-rich- platelets suspension (LR-PRP) seemed to be more effective for such purpose of the use.

**Table 4: The Characteristics of Women Included into Study**

| Parameter | No | Range | Mean value |
|---|---|---|---|
| Patients (age in years) | 25 | 24-50 | 39.49 |
| Infertility: primary (years) | 21 | 1 – 12 | 5.85 |
| secondary (years) | 4 | 1 – 6 | 3.5 |
| Miscarriages | 2 | | |
| Other diseases: | | | |
| Hypothyrosis (without antibodies) | 2 | | |
| Hashimoto disease | 1 | | |
| Endometriosis | 1 | | |
| Clinical status: | | | |
| AMH | 25 | 0.02 – 1.58 | 0.3518 |
| IVF (patients) | 23 | | |
| (procedures) | 48 | 1 – 5 | 2.08 |

## PRP Activity Mechanisms

The known properties of the platelets including the leukocytes addition (in different proportion) the mechanisms of PRP activity may be settled as follow:

- Regulation and modulation of the proinflammatory cytokines secretion and activation of cells involved in the inflammation process. In particular inflammation PRP is modulating the proportion of neutrophils and lymphocytes in the inflammatory infiltration (e.g. in acute damage of lung tissue PRP increased migration of neutrophils to injury place). The inhibitory modulation was showed in prolonged wound through the inhibition of proinflammatory cytokines secretion supporting inflammation and in effect the regeneration and healing process was possible.
- Orchestrating and remodelling the extracellular proteins composition with synthesis of the collagen and fibronectin.
- Stimulation of the angiogenesis with secretion of VEGF. It is important mechanism for the tissue regeneration especially after surgery. Moreover, for the tissue with preserved vessels net VEGF improved the blood supply promoting the regeneration e.g. the ovaries, endometrium, tendons or muscles. This effect of increased neo angiogenesis is believed to be basic for the clinical effects of PRP in the hair loss, the jaw and mandibula bones damage.
- Regulation and direction of the cellular recruitment and migration to the injection side (e.g. ovary) including the mesenchymal stem cells, fibroblast thereby promoting the differentiation and maturation in reparative process [6,7,14].

## PRP Infertility Therapy

The first indications for PRP in infertile women were the thin endometrium with the very good results supporting this indication up to now [14,15,12,8]. Following application of PRP was the revitalization of ovary in women diagnosed as POI/POF, the low ovary reserve (POR) with very optimistic results estimated as the increased number of oocytes and the parameters of ovary reserve [9,11,10,16,4].

The role of endometrium, especially endometrial receptivity, is an essential element for the blastocyst, embryo implantation as the first step for pregnancy. The assay of the endometrium thickness showing thin endometrium was consider as the possible cause of implantation failure, so the different method of the endometrial thickness improvement was proposed. PRP

as the source of factors (TGF, VEGF, IGF, PDGF and EGF) with their activity in modulation, growth and stimulation of the proliferating cells number, better vascularisation (due to sub-endometrial angiogenesis), regeneration of the endometrial tissues is supporting the improvement of endometrial receptivity [12]. The clinical trials including women with thin endometrium (<7mm) showed the marked increase of the endometrium thickness after intrauterine infusion of PRP. The summary of 11 papers, showed the increase of endometrium thickness in the majority of patients. In 3 papers the higher LBR was noted and concerned as an effect of this procedure [7].

Moreover, the increase of endometrium thickness after PRP was observed in women classified as the non-responding endometrium ("refractory"). However, the observations of these women showed the increase of endometrium thickness after PRP below expectations means that this procedure is effective with different intensity of this effect. The refractory endometrium to PRP infusions is not the cause of infertility as in a group of 20 women with the refractory endometrium after PRP infusions, 4 women were pregnant delivering the healthy children, in 2 other women the pregnancy finished with miscarriages and one woman showed chemical pregnancy only [15]. These results support the used of the intrauterine infusions of PRP in women with thin endometrium even classified as refractory type.

The revitalisation of the ovary function with PRP intraovarian injection is the more complex problem. The results are different, so there are summarise with caution, however, this type of therapy is still indicated in women with POI, low reserve (AMH) level. The study underlined the increase of oocytes number in majority of women. The following observations were not so optimistic due to low number of successful pregnancies [9]. In a group of 12 women 40-50 years old without menstruation for more than 1 year, the supplementation of gonadotropin and the injection of PRP restored the ovarian function with the possibility to obtain oocytes, albeit, this result was transient. In another group of 80 women with low ovarian reserve after PRP the clinical significant effects were not observed [7].
In other studies, the significant increase of AMH level measured before and after PRP injection showed in all groups of women, wasn't clearly correlated with the number of retrieved mature oocytes [9]. The comparison of the effects of PRP intraovarian injection given once or twice did not showed differences in the increase of AMH level, number of antral follicles and number of retrieved oocytes between singular or repeated PRP injections [10]. PRP is still used as the method of ovarian function improvement, however, the final result is depending of individual state of woman [9,11,10,16,4].

**PRP in Case of ART Failure**

The indications for PRP besides the typical indication of the thin endometrium and the ovary function disorders, included women after the failure of ART procedures [12,17-21,7]. The summary of 11 papers showed the intrauterine use of PRP in women with RIF resulting in the increased number of pregnancies and delivery of healthy children. The comparison of the clinical effects of PRP and neutrophil growth factor (G-CSF) used in the infertility therapy showed much better results after PRP including the chemical and clinical pregnancies (36% and 33% respectively in comparison to 1.4% and 6% after G-CSF) [19]. However, the lack of standardization of indications and schedule of use these both methods is the main problem of unequivocal analysis of these studies.

**Methods and Patients**

The study group included 25 women with diagnosis of primary (21) and secondary (4) infertility with mean value of age - 39 ages. The all included into women were diagnosed as low ovary reserve (AMH). The miscarriages in history were noted in 2 women. The main disease important for fertility were thyroid diseases diagnosed as hypothyrosis without antibodies in 2 women, typical Hashimoto disease in one of them. The endometriosis was diagnosed in one woman.

**PRP Infusions**

The women included into study were treated with PRP after weak effect of typical stimulation of the ovary function (puregon, bemfola, recovell) and low number of oocytes retrieved in biopsy. PRP prepared from their peripheral blood with Angel-Artrex system was injected into both ovaries (3.0-4.0 ml each) and infused into uterus (remaining 2.0-3.0 ml) during one procedure under short anesthesia. Injections into ovary tissues subcortical were performed with needles used by IVF retrieval, into uterus with catheter. In majority it was only one, however, the repeated injection was performed according to the individual indications.

**Procedures ART**

The initial laboratory tests included – blood smear, basic biochemical tests, hormones level (FSH, LH, Estradiol, PRL, TSH, AMH for ovary reserve) and autoantibodies for autoimmunity process and/or disease if any clinical symptoms were present. The biopsy of endometrium was analysed for CD138 and NK (CD16/CD56) cells and antibiotics (doxycycline, metronidazole, azytromycine) were introduced for therapy of subclinical endometritis after positive results of test.

There were 2 regular protocols of stimulation – short one and longer one. The decision was made based on the ovary function parameters (hormones level, number of antral follicles), menstrual cycles and hormonal axis tests results according standard indications and typical criteria.

ART included insemination and IVF with oocytes of woman and partner's spermatozoid. The optional for women with low number of oocytes or problems with development of blastocysts after fertilization was to take the advantage of the oocyte or blastocyst from donor bank. The similar option was for man with problems of normal spermatozoid production (e.g. azoospermia after chemotherapy).

**Results**

The study of AMH (ovary reserve) were studied in 25 women, tested in our (17women) or in other medical facilities (8 women) the diagnosed as the low ovary reserve associated with infertility. The value above 1.0 was noted in 3 patients – 2 of them diagnosed as secondary infertility, one – primary infertility. The IVF procedure was introduced in 23 women in majority only 1 time, in 12 women more than one (up to 5 times). The oocytes retrieved during biopsy were from 1 cell to 14 cells (one woman), however, in majority of patients there were no blastocysts growing.

In 5 women (patients 14, 15, 18, 19, 21) after IVF failure with their own blastocysts, the donor oocytes were used with following pregnancy (tweens) only in one of them (patient 19). The PRP was injected into ovary tissue and into uterus in all women included into study in majority only once, in 5 patients more than one time (2-4 in patients 1, 5, 7, 20). However, there is no predictive factor or results of the standard stimulation or results of PRP for prognosis of IVF success.

**Table 5: The Effect of PRP Used in ART Therapy of Infertility in Studied Group of Women Observation for More than One Year**

| No | | Age years | Pregn | Misc | Infert years | Stim | PRP ( x) | AMH | Oocytes (biopsy) | IVF ( x) | Pregn | Misc | Other diseases | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | K.J. | 36 | 1 | 1 | 8 | + | 3 | 0.11 | no | no | 0 | 0 | | |
| 2 | S.E. | 43 | 0 | 0 | 10 | + | 1 | 0.03 | 3 | 1 | 0 | 0 | | |
| 3 | J-A.E | 42 | 0 | 0 | 12 | + | 1 | 0.02 | 2 | 1 | 0 | 0 | Hashimoto | |
| 4 | M.M. | 39 | 0 | 1 | 2 | + | 1 | 0.46 | 2, 4 | 2 | 1 | 0 | | chemical |
| 5 | C-C.W. | 29<br>32 | 0 | 0 | 1 | + | 4<br>2 | 0.09<br>0.04 | 3,0<br>1,2,4,2 | 2<br>2 | 0<br>1 | 0 | Endometriosis | 25 weeks |
| 6 | M.A. | 24 | 1 | 0 | 1 | + | 1 | 1.1, 1.3 | 4 | 1 | 1 | | Hypothyrosis | secondary |
| 7 | S.A. | 35 | 0 | 0 | 5 | + | 3 | 0.08 | 1,2 | 0 | 0 | | | no blastocysts |
| 8 | M-T.A. | 44 | 0 | 0 | 10 | + | 1 | 0.11 | 2 | 1 | 0 | | | |
| 9 | N.N. | 46 | 0 | 0 | 10 | + | 2 | 0.01 | 2,2,3 | 5 | 1 | 1 | | 6 weeks |
| 10 | S.M. | 46 | 0 | 0 | 10 | + | 1 | 0.1 | 1,2,1 | 3 | 0 | | | |
| 11 | S.M. | 39 | 0 | 0 | 8 | + | 1 | 0.12 | 2,1 | 1 | 0 | | | IVIG 10g 1x |
| 12 | G.A. | 43 | 0 | 0 | 6 | + | 1 | 0.03 | 1,2 | 1 | 0 | | | |
| 13 | S.A. | 40 | 0 | 0 | 2 | + | 1 | 0.5 | 1,2,3 | 1 | 0 | | | no blastocysts |
| 14 | W-T.J. | 44 | 1 | 2 | 6 | + | 1 | 0.03 | donor | 1 | 0 | | | secondary |
| 15 | Ch.B. | 34 | 0 | 0 | 8 | + | 1 | 0.05 | 1,1,1,1donor | 3 | 0,0 | | | no blastocysts |
| 16 | G.I. | 36 | 0 | 0 | 11 | + | 1 | 0.54 | 3,1,1,1 | 3 | 0 | | | |
| 17 | J-J.K. | 37 | 0 | 0 | 6 | + | 1 | 1.58 | 3,2,1,1,5 | 2 | 0 | | | no blastocysts |
| 18 | S.E. | 43 | 0 | 0 | 3 | + | 1 | 0.74 | 3,1,3,3,donor | 2,1 | 0 | | | no blastocysts |
| 19 | B.J. | 40 | 0 | 0 | 7 | + | 1 | 0.02 | 2,1<br>donor | | | | | No blastocysts IVIG 3x, tweens |
| 20 | Sz.D. | 50 | 1 | 0 | 3 | + | 2 | 1.53 | 3,2,35 | 1 | 1 | | Hypothyrosis | secondary |
| 21 | B.M. | 34 | 0 | 0 | 3 | + | 1 | 0.03 | donor | 4 | 0 | | | |
| 22 | P.J. | 40 | 0 | 0 | 7 | + | 1 | 0.75 | 1,3,4,2 | 3 | 1 | | | |
| 23 | K.E. | 43 | 1 | 0 | 4 | + | 1 | 0.42 | 14,7 | 3 | 1 | | | IVIG, secondary |
| 24 | D.J. | 31 | 0 | 0 | 3 | + | 1 | 0.35 | 2 | 2 | 0 | | | |
| 25 | T.J. | 44 | 0 | 0 | 8 | + | 1 | 0.27 | 3 | 1 | 0 | | | |

**Abbreviations:** Pregn – Pregnancies, Misc – Miscarriages, Stim – Stimulation to IVF, IVF – in Vitro Fertilisation, PRP – Platelets Rich Plasma.

## Comments and Conclusions

PRP as the safe method to support the regeneration and revitalization process is indicated in women diagnosed with the disorders of ovary function, the premature ovarian failure, the processes leading to low thickness of endometrium and infertility with the unknown reason including the failure of ART.

In our study of women diagnosed as primary and secondary infertility the positive effect of PRP injected into the ovary tissue and the uterus was noted as increased number of the oocytes retrieved in biopsy and increased LBR. The addition of RP into standard ART procedures leading to the improvement of the endometrium thickness and the ovary function increased the possibility of pregnancy and successful child delivery.

## References

1. Amable PR, Crias RBV, Teixteira MVT, da Cruz Pacheco I, Correa da Amaral RJF, et al. (2013) Platelet-rich plasma preparation for regenerative medicine: optimization and quantification of cytokines and growth factors. Stem Cell Research Therapy 4.
2. Parrish WR, Roides B, Hwang J, Mafilios M, Story B, et al. (2016) Normal platelet function in platelet concentrates requires non-platelet cells: a comparative in vitro evaluation of leukocyte-rich (type-1a) and leukocyte-poor (type 3b) platelet concentration. BMJ Open Sport Exerc Med 2: e 000071.
3. Ribeiro LS, Bronco LM and Franklin S (2019) Regulation of innate immune responses by platelets. Frontiers in Immunology 10: 1320.
4. Moustakli E, Potiris A, Zikopoulos A, zachariou A, Topis S, et al. (2025) Platelet-rich plasma (PRP) in reproductive medicine. Review of PRP therapy in low-reserve and premature ovaria insufficiency. Biomedicines 13: 1257.
5. Rossaint J, Margraf A, Zarbock A (2018) Role of platelets in leukocyte recruitment and resolution of inflammation. Frontiers in Immunology 9: 2712.
6. Pineda-Cortel MR, Suarez C, Cabrera JT, Daya M, Bernardo-Bueno MM, et al. (2023) Biotherapeutic applications of platelet-rich plasma in regenerative medicine. Tissue Eng

Regen Med 20: 811-828.
7. Serdarogullari M, Raad G, Makieva S, Liperis G, Fraire-Zamora JJ, et al. (2024) Revitalizing female fertility: platelet-rich plasma – hype or hope? RBMO 49: 103813.
8. Sills ES, Wood SH (2019) Autologous activated platelet-rich plasma injection into adult human ovary tissue. Bioscience Reports 39: 0805.
9. Panda SR, Sachan S, HotA S (2020) A systematic review evaluating the efficacy of intra-ovarian infusion of autologous platelet-rich plasma in patients with poor ovarian reserve or ovarian insufficiency. Cureus 12: e12037.
10. Li Q, Guo Jy, Liu Jw, Zou Ln, Fang C, et al. (2025) Comparative efficacy of single vs double autologous platelet-rich plasma ovarian injections for improving ovarian response in poor ovarian responders. Scientific Reports 15: 18292.
11. Seckin S, Ramdan H, Mouanness M, Kohansieh M and Merhi Z (2022) Ovarian response to intraovarian platelet-rich plasma (PRP) administration. J Assisted Reproduction Genetics 39: 37-61.
12. Karadbhajne P, Dzoagbe HY, More A (2024) Platelet-rich plasma (PRP) for endometrial treatment efficacy and safety in assisted reproductive technology. Cureus 16: e59728.
13. Mautner K, Malnaga GA, Smith J, Shiple B, Ibrahim V, et al. (2015) A call for a standard classification system for future biologic research: rationale for new PRP nomenclature. Physical Medicine Rehabilitation 7: S63-S69.
14. Rodriguez-Eguren A, Buebo-Fernandez C, Gomez-Alvarez M, Frances-Herrero E, Pellicer A, et al. (2024) Evolution of biotechnological advances and regenerative therapies for endometrial disorders. Human Reproduction Update 30: 584-613.
15. Kim H, Shin JE, Koo HS, Kwon H, Choi DH, et al. (2019) Effect of autologous platelet-rich plasma treatment on refractory thin endometrium during the frozen embryo transfer cycle. Frontiers in Endocrinology 10.
16. Devenutto L, Quintana R, Quintana T (2020) In vitro activation of ovarian cortex and autologous transplantation: a novel approach to primary ovarian insufficiency and diminished ovarian reserve. Human Reproduction Open 2020: hoaa046.
17. Xie Q, Quan X, Lan Y, Yang X (2024) Uterine infusion strategies for infertile patients with recurrent implantation failure. Reproductive Biology Endocrinology 22: 01221-x.
18. Mehrafza M, Pourseify G, Yousefi, Aoufi A, Jalali SS, et al. (2024) The efficiency of introducing intrauterine infusion of autologous platelet-rich plasma versus granulocyte colony-stimulating factor in repeated implantation failure patients. Int J Feritl Steril 18: 30-34.
19. Cakiroglu Y, Saltik A, Yuceturk A, Karaosmanoglu O, Kopuk SY, et al. (2020) Effects of intraovarian injection of autologous platelet rich plasma on ovarian reserve and IVF outcome parameters in women with primary ovarian insufficiency. Aging 12: 10211-10222.
20. Goncalves NJN, Frantz N and de Oliveira M (2019) Platelet-rich plasma (PRP) therapy: An approach in reproductive medicine based on successful animal model. Anim. Reprod 16: 93-98.
21. Sharara FI, Lelea LL, Rahman S, Klebanoff JS, Moawad GN (2021) A narrative review of platelet-rich plasma in reproductive medicine. J Assisted Reproduction Genetics 38: 1003-1012.

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