Osteoblastic Differentiation of Human Mesenchymal Stem Cells with Platelet-Lysate

Nathalie Chevallier, Fani Anagnostou, Sebastian Zilber, Gwellaouen Bodvili, Sophie Maurin, Aurelie Barrault, Philippe Bierling, Philippe Herrnigou, Pierre Layrolle and Helene Rouard

ABSTRACT

Culture of expanded mesenchymal stem cells (MSCs) seeded on biomaterials may represent a clinical alternative to autologous bone graft in bone regeneration. Fetal bovine serum (FBS) is currently used for MSC expansion, despite risks of infectious disease transmission and immunological reaction due to its xenogenic origin. This study aimed to compare the osteogenic capacities of clinical-grade human MSCs cultured with FBS or allogenic human platelet lysate (PL). In vitro, MSCs cultured in PL both accelerate the expansion rate over serial passages and capacities of clinical-grade human MSCs cultured with FBS or allogenic human platelet lysate currently used for MSC expansion, despite risks of infectious disease transmission and immunological reaction.

GOAL

Amplification:

Classical medium with FBS:
- risk of infectious disease transmission
- immunological reaction

What about medium with human Platelet Lysate (PL)?

Osteoinduction?

PL contains numerous growth factors, some of which are known to have osteo-inductive effects.

PL Effect:
- On osteoblastic gene expression
- On in vivo bone formation

RESULTS

Effect of PL on MSC primary culture

- PL significantly increased MSC expansion in vitro by 2.8 fold
- MSC cultured in PL are smaller
- Cells cultured in PL retained MSC phenotype
- MSC cultured in PL are not transformed

Effect of PL on osteoblastic differentiation

- PL spontaneously induced osteoblastic gene expression
- Quantitative RT-PCR
- Experimental procedure
- MSC expanded in PL improved in vivo bone formation

CONCLUSIONS

- Using PL in culture medium is an advantage for MSC clinical grade production:
  - PL is a human origin
  - PL increase cells growth
  - MSC grown in PL are smaller, so using PL can reduce cell culture area

- In vitro, PL primes MSC to osteoblastic orientation. This is an advantage for bone formation in vivo.
- PL medium also stimulates the expression of the strong osteo-inductive agent BMP2. This can be an advantage for an autocrine and paracrine osteoblastic differentiation.