$$\cot\alpha = \frac{b^2+c^2-a^2}{4\mathit{\Delta}}, \qquad \cot\beta = \frac{c^2+a^2-b^2}{4\mathit{\Delta}}, \qquad \cot\gamma = \frac{a^2+b^2-c^2}{4\mathit{\Delta}},$$

$$\cot\beta+\cot\gamma = \frac{\sin(\beta+\gamma)}{\sin\beta\sin\gamma} = \frac{\sin\alpha}{\sin\beta\sin\gamma} = \frac{2\sin\alpha}{\cos(\beta-\gamma)+\cos\alpha} = \frac{2aR}{bc} = \frac{a^2}{2\mathit{\Delta}},$$

$$\cot\gamma+\cot\alpha = \frac{\sin(\gamma+\alpha)}{\sin\gamma\sin\alpha} = \frac{\sin\beta}{\sin\gamma\sin\alpha} = \frac{2\sin\beta}{\cos(\gamma-\alpha)+\cos\beta} = \frac{2bR}{ca} = \frac{b^2}{2\mathit{\Delta}},$$

$$\cot\alpha+\cot\beta = \frac{\sin(\alpha+\beta)}{\sin\alpha\sin\beta} = \frac{\sin\gamma}{\sin\alpha\sin\beta} = \frac{2\sin\gamma}{\cos(\alpha-\beta)+\cos\gamma} = \frac{2cR}{ab} = \frac{c^2}{2\mathit{\Delta}},$$

$$\cot\alpha+\cot\beta+\cot\gamma = \frac{a^2+b^2+c^2}{4\mathit{\Delta}} = \frac{s^2-4Rr-r^2}{2rs},$$

$$\cot^2\alpha+\cot^2\beta+\cot^2\gamma = \frac{(s^2-4Rr-r^2)^2}{4r^2s^2}-2,$$

$$\cot\beta\cot\gamma+\cot\gamma\cot\alpha+\cot\alpha\cot\beta = 1,$$

$$\cot\alpha\cot\beta\cot\gamma = \frac{s^2-(2R+r)^2}{2rs},$$

$$(\cot\alpha+\cot\beta)(\cot\beta+\cot\gamma)(\cot\gamma+\cot\alpha) = \frac{2R^2}{rs},$$

$$\cot^3\alpha+\cot^3\beta+\cot^3\gamma = \frac{(s^2-4Rr-r^2)^3-48R^2r^2s^2}{8r^3s^3},$$