$$p(r \mid y, N) \propto p(y = y \mid r, N)\, p(r)$$

$$\propto r^{y} (1-r)^{N-y} \times 2r$$

$$\propto r^{y+1} (1-r)^{N-y}$$

$$= r^{\alpha'-1} (1-r)^{\beta'-1}$$

$$\therefore \alpha' = y+2 \quad , \beta' = N-y+1$$

$p(r) \propto r^{\alpha-1} (1-r)^{\beta-1}$, for this to be proportional to $2r$. $\alpha = 2$, $\beta = 1$, which gives

$$p(r) \propto r^{2-1} (1-r)^{1-1}$$

$$\propto r^{1} (1-r)^{0}$$

$$\propto r$$