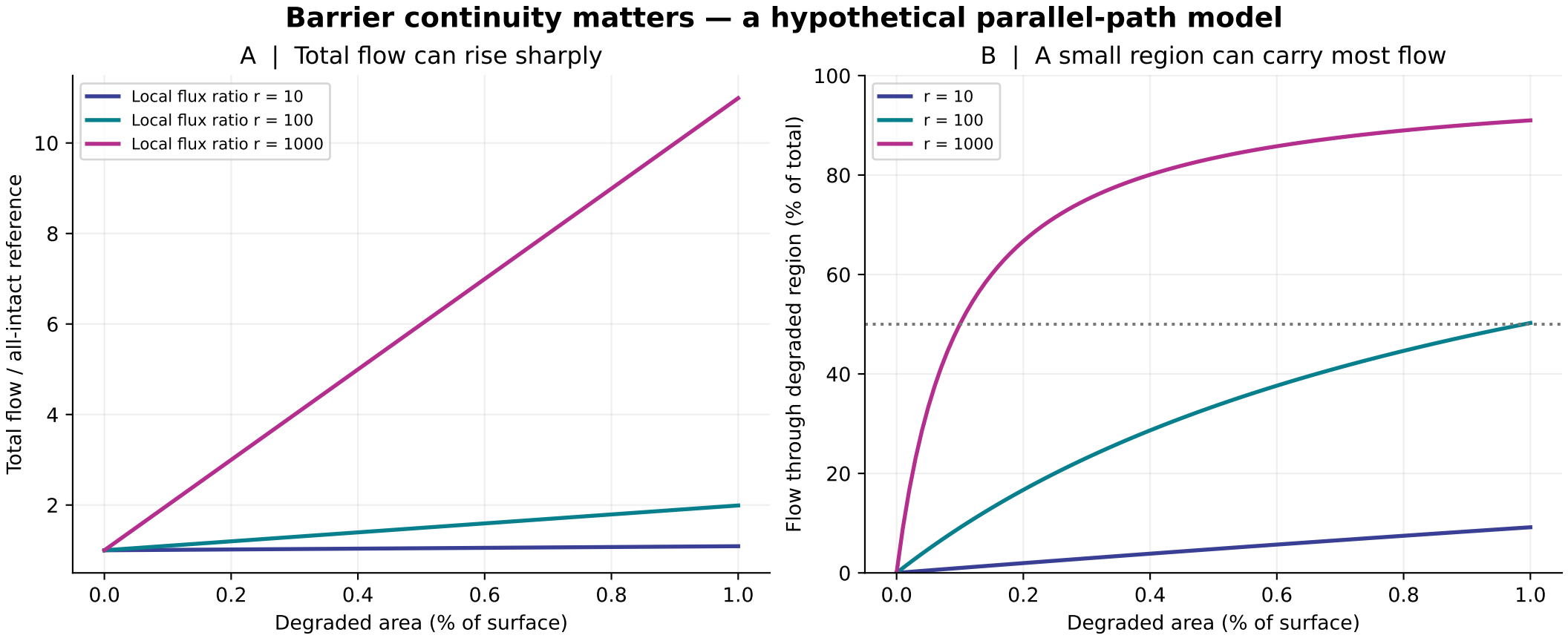

Barrier continuity matters — a hypothetical parallel-path model
A | Total flow can rise sharply
Local flux ratio r = 10
Local flux ratio r = 100
Local flux ratio r = 1000
Total flow / all-intact reference
2
4
6
8
10
0.0
0.2
0.4
0.6
0.8
1.0
Degraded area (% of surface)
B | A small region can carry most flow
r = 10
r = 100
r = 1000
Flow through degraded region (% of total)
0
20
40
60
80
100
0.0
0.2
0.4
0.6
0.8
1.0
Degraded area (% of surface)
Prescribed local flux ratios, identical driving conditions. These curves do not predict real pinhole leakage or protective efficacy.