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Comparison problems for the Radon transform

Given two non-negative functions f and g such that the Radon transform of f is pointwise smaller than the Radon transform of g, does it follow that the L^p-norm of f is smaller than the L^p-norm of g for a given $p > 1$? We consider this problem for the classical and spherical Radon transforms. In both cases we point out classes of functions for which the answer is affirmative, and show that in general the answer is negative if the functions do not belong to these classes. The results are in the spirit of the solution of the Busemann-Petty problem from convex geometry, and the classes of functions that we introduce generalize the class of intersection bodies introduced by Lutwak in 1988. We also deduce slicing inequalities that are related to the well-known Oberlin-Stein type estimates for the Radon transform.