Extension problem and fractional powers of generators

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We extend results of Caffarelli-Silvestre and Stinga-Torrea regarding a characterization of fractional powers of differential operators via an extension problem. Conversely, a solution to the extension problem is given in terms of the fractional power. Our main result applies to generators A of integrated semigroups, in particular to operators with purely imaginary symbol. We also give a result on the growth of perturbated tempered α-times integrated semigroups, that could be of independent interest.